An Examination and Assessment of the Development and Application of a Management Framework for Coastal Zone Management within the Moray Firth Coastal Zone

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Contents.

List of Contents:

List of Figures:

List of Tables:

List of Maps:

List of Charts:

List of Appendices:

List of Abbreviations and Acronyms:

This list expands terms used more than once in this thesis and not always set out in full.

AODC - Association of Offshore Diving Contractors
BASC - British Association for Shooting and Conservation
BGS - British Geological Survey
BP - British Petroleum
CEC - Crown Estate Commissioners
CFP - Common Fisheries Policy
DoT - Department of Transport
DTI - Department of Trade and Industry
EC - European Community
EEZ - Exclusive Economic Zone
EPSRC - Engineering & Physical Science Research Council
FCO - Foreign and Commonwealth Office
GIS - Geographic Information System
HIE - Highlands and Islands Enterprise
HM - Her Majesty's
HMC&E - Her Majesty's Customs and Excise

HMIPI - Her Majesty's Industrial Pollution Inspectorate
HRPB - Highland River Purification Board
HSC - Health and Safety Commission
HSE - Health and Safety Executive
IDG - Inter-Department Group
IMO - International Maritime Organisation
LCDC - Land Conservation and Development Commission
LNR - Local Nature Reserve
MCA - Marine Consultation Area
MCS - Marine Conservation Society
MNR - Marine Nature Reserve
MoD - Ministry of Defence
MPCU - Marine Pollution Control Unit
NERC - Natural Environment Research Council
NERPB - North East River Purification Board
NNR - National Nature Reserve
RAF - Royal Air Force
RSPB - Royal Society for the Protection of Birds
SFPA - Scottish Fisheries Protection Agency
SNH - Scottish Natural Heritage
SO - Scottish Office
SOAFD - Scottish Office Agriculture and Fisheries Department
SOEnD - Scottish Office Environment Department
SSAC - Scottish Sub-Aqua Club
SSSI - Site of Special Scientific Interest
UK - United Kingdom
UKCS - United Kingdom Continental Shelf
UKOOA - United Kingdom Offshore Operators Association
UN - United Nations
WWF - World Wide Fund for Nature

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Abstract.

The management framework for coastal zone management developed in this thesis was based on two fundamental principles concerned with a proper understanding of the coastal zone and a structurally representative management process. The rigorous application of these two principles within the Moray Firth resulted in the development of a four stage management framework with the potential to overcome the inadequacies of the existing planning and management regime operating within the coastal zone.

The effectiveness of this framework to deal with coastal issues of concern was assessed in an investigation of conflict management and resolution through the development of a zoning scheme. The framework proved capable of answering five questions identified as having to be answered if zoning is to be used to achieve stakeholder consensus and agreement concerning conflicts of use. The management framework thus has much to recommend it as an essential requirement for the successful implementation of coastal zone management within the other twenty coastal regions identified in the UK.

As opposed to earlier recommendations made concerning coastal zone management in the UK, the framework developed provides a more effective means of: (a) generating and disseminating information, (b) increasing public participation from a consultation to partnership level, (c) increasing communication between and awareness of stakeholders, (d) reaching management decisions regarding coastal issues of concern, and (e) implementing and enforcing management decisions. These products of the management framework result in the co-ordinated management of the coastal zone.

Chapter 1: Introduction.

1.1. *Introduction.*

Coastal zone management as a phrase and a concept has been around for only a relatively short period of time, with the first moves towards implementation occurring in the USA with the passing of the 1972 Coastal Zone Management Act.[1] The original concern was the reduction of the pollution and adverse affects on amenities caused by urban sprawl and industrial development. A better planning and management regime was therefore needed to control the increasing conflicts arising within the coastal zone.[2]

1.2. *Defining the Coastal Zone and Coastal Zone Management.*

1.2.1. The Coastal Zone.

The term coastal zone conveys the notion of a land-sea interface. This interface has two axes, one axis which is parallel to the shore (longshore), and another axis which is perpendicular to the shore (on / offshore). Regarding the longshore axis, relatively little controversy arises about its definition since it does not typically cross environmental system boundaries. In contrast, there is considerable discussion about the on / offshore axis. For example, the inland definitions of the coastal zone range from those that include entire watersheds to those that comprise only the immediate strip of shoreland adjacent to the coast. Likewise, the seaward limit can extend as far as the maximum reach of a country's jurisdiction, that is, out to the 200 nautical mile Exclusive Economic Zone (EEZ) limit.[3] However, which ever definition is used to determine the coastal zone, it will still contain diverse habitats together with the plants and animals which live there.

Human impact in this zone can be equally wide ranging and the potential scale and complexity of the interactions is immense. For planning purposes the zone can also be defined according to human uses and activities which occur there. Taken from both these perspectives, the coastal zone is defined by a combination of natural features and human activities which may interact across the whole zone or within individual components of the zone. Recognition of this interaction is the first stage in understanding the need for an organised approach to management in the coastal zone.[4]

1.2.2. Coastal Zone Management.

From a nature conservation point of view coastal zone management could be defined as a means of providing a framework for the development of strategies for the protection of the natural coastline and marine areas, including the dynamic operation of coastal processes. However, by this definition the importance of human use and exploitation of the coastal zone and its ability to accommodate change without loss of value, is ignored.[4] Therefore, from a resource management perspective, a more pragmatic definition might be that coastal zone management –"is a dynamic process in which a co-ordinated strategy is developed and implemented for the integration of human activities within a zone defined by natural processes which facilitates the sustained use and exploitation of the resources without degrading the environment." [4,5]

1.3. *Methodological Justification of the Thesis.*

As indicated by Section 1.2, there is no unique fixed definition of the coastal zone, let alone of coastal zone management. Only a very few nations have developed a coastal zone management programme on an operational basis. In most countries some coastal zone management aspects are dealt with on an 'ad hoc' basis, whereas many coastal zone management aspects are hardly dealt with at all. Yet, the need for some sort of organised coastal management is increasingly recognised.

World-wide coastal areas tend to be densely populated, economically productive and environmentally sensitive. In many instances such a combination of properties have led to resource use conflicts and environmental degradation. Consequently, these coastal areas are coming under increasing pressure. Therefore, appropriate coastal resource allocation and harmonising of resource functions becomes increasingly desirable. This could be achieved in a coastal zone management framework.[6]

Within the UK, coastal zone resource use conflicts occur on the jurisdictional edge of the land planning system, and extend into the sea where the planning system does not apply. It is a general presumption that coastal zone management will provide a means of reducing

such conflicts. More over it may provide a means of more clearly identifying goals and objectives for the management of such areas.

Specifically the thesis sets out to explore these presumptions and to gain insights into the process associated with management by:

- Taking the Moray Firth as a case study area for coastal zone management.
- Developing a management framework for coastal zone management.
- Applying this framework to the case study area.

1.3.1. Justification of the Case Study Area.

As stated above, the Moray Firth coastal zone was adopted as the case study area for the thesis. Within this area, the management framework developed for coastal zone management, outlined in Section 1.3.2, has been rigorously applied to examine whether its implementation could form a valid basis for coastal zone management.

Map 1, Section 1.4 illustrates the area comprising the Moray Firth, that is, the Duncansby Head-Beauly-Fraserburgh triangle of the north-east of Scotland. This area was chosen for two main reasons over and above the fact that the Moray Firth is a recognised and clearly identifiable geographic unit.

The first reason was concerned with the unique contrasts that are present within the Moray Firth in the context of its position on the east coast of Scotland. That is to say, in common with the rest of the east coast of Scotland the Moray Firth coastal zone is a fairly populous area accounting for the majority of the people that live permanently within the Scottish Highlands. Inevitably such a concentration of people brings with it demands for development in order to provide work, housing and increased prosperity for the population as a whole. However, in contrast to the rest of the east coast of Scotland, and what is unique about the Moray Firth, is the fact that at the same time the Moray Firth has retained quite substantial areas that are undeveloped, including the Dornoch Firth which is the only remaining major undeveloped Firth on the east coast of Scotland. In addition to this, the Moray Firth also provides for and supports a rich and varied flora and fauna including over

wintering internationally important wildfowl populations, and the only resident group of bottlenose dolphins (*Tursiops truncatus*) in the North Sea.

Therefore, at this present time it could be argued that a crucial stage in the planning and management of the Moray Firth has been reached. In other words, an acceptable balance has been reached within the Moray Firth coastal zone between the need for development and the need for conservation. If this situation is to be maintained in the future though, given the fact that demands upon the coastal resource are only likely to increase, there would appear to be a requirement for a management framework which facilitates the sustained use and exploitation of coastal resources without degrading the environment, that is, coastal zone management.

The second reason for choosing the Moray Firth was that Highland Regional Council, which is the planning authority for over 50% of the Moray Firth coastal zone above the low water mark, at around the same time had reached a similar conclusion. Mainly that its coastal zone, including that within the Moray Firth, would benefit form the instigation of the principles of coastal zone management.

Specifically, in the early 1990s the Council agreed to progress a coastal zone management initiative, stating that the rationale for developing an integrated system of coastal zone management around the Highland Region had never been stronger, citing that the proper management of its coastal areas and inshore waters was being hindered by fragmented official responsibilities and a lack of information on the processes and characteristics of its coastal zone.

Two areas of Highland Region were short listed for the development of a pilot study into the effectiveness of possible coastal zone management framework plans, these were the Moray Firth, and the Isle of Skye and adjacent mainland. The Council stated that nature conservation interests were strong around the inner Moray Firth, and that these needed to be reconciled with major industrial interests and onshore development pressures. However, it was decided that perhaps the best choice for an initial pilot study was to explore the wide range of issues connected with the management of the coast and inshore

waters of the Isle of Skye and the adjacent mainland.[7] It is perhaps interesting to note at this point that one factor put forward in favour of the Skye option was the fact that some exploratory work into coastal zone management had been done on Skye in the late 1980s by an MSc researcher at the Institute of Offshore Engineering, Heriot-Watt University.

Once the decision was made to adopt Skye for the Council's pilot project however, the Council expressed that it would welcome any investigations into coastal zone management concerning the Moray Firth. Also that such a line of study could form the basis of an interesting doctoral research project and certainly aid any future coastal zone management plans the Council may have for the rest of its region.

1.3.2. Development of a Management Framework.

The initial concept for the management framework for coastal zone management, identified at the outset, was based on two fundamental principles. Firstly that the area of coast available is finite, and there is a danger therefore that the coastal resource could be over exploited. The risk of loss or conflict between resource uses is further exacerbated by the dynamic and sensitive nature of the interface between land and sea. This requires that managers endeavour to work with rather than against nature, implying that efforts to manage the coast must be based on a proper understanding of the processes and characteristics of the coastal zone.[8]

Such an understanding of the processes and characteristics of the Moray Firth coastal zone was fulfilled by the 'information gathering' stage of the management framework. This stage of the management framework developed for the thesis evolved out of:

- A detailed study of the area to be managed, that is, the Moray Firth. This involved a literature review, data gathering and the use of questionnaires and interviews.
- An examination of the land planning system and the management systems presently applying to sea use and activity.
- An analysis of the inputs from stakeholders identified concerning coastal zone issues, for example, conflicts of use.

The second fundamental principle of the initial management framework concept was that the management process should be structurally representative of the stakeholders of the coastal zone. To this end, several aims and objectives for the management of the Moray Firth coastal zone were identified, as well as management response options designed to achieve these aims and objectives.

The fundamental response option identified was that the management framework for coastal zone management must be participative, and that any participative approach adopted should be structurally representative of the stakeholders within the Moray Firth coastal zone. In addition, there should be no explicit or implicit weighting given to any participating stakeholder within the process. This contrasts the approach to coastal zone management taken by statutory bodies such as Scottish Natural Heritage (SNH). Here coastal zone management is explicitly identified as a tool for nature conservation. However, as stated in Section 1.2.2, such an approach ignores the importance of human use and exploitation of the coastal zone and its ability to accommodate change without loss of value.[4]

The second stage of the management framework, which includes the main participatory element, termed the 'management process' has three key requirements, which are, information, co-operation and negotiation. As already stated, the information necessary for the process of coastal zone management was identified in the initial stages of the thesis. However, in reality, the majority of such information would be supplied by the stakeholders of the coastal zone themselves, as part of the management process. That is to say, that as part of the management process, the stakeholders would provide a level of information necessary for them to make management decisions.

This uncertainty regarding the exact level of information required within the management process explains why the coastal zone information presented in the thesis regarding the Moray Firth is of such a detailed nature. The author can not precisely predict the 'specific' information that would be required, and therefore, as much 'relevant' information as possible has been included.

Co-operation and negotiation are the next important requirements of this stage of the management framework. However, the achievement of these requirements requires the setting up of a constructive problem solving environment for the stakeholders. Such an environment was developed following an investigation of:

- The institutional arrangements for coastal zone management in coastal nations.
- Theoretical institutional arrangements possible for coastal zone management in the UK.

As a direct result of the negotiations and co-operation developed within suitable institutional arrangements, it may be possible for coastal zone stakeholders to reach a consensus concerning management decisions with regard to particular coastal zone issues. The reaching of 'management decisions' is the third stage of the management framework.

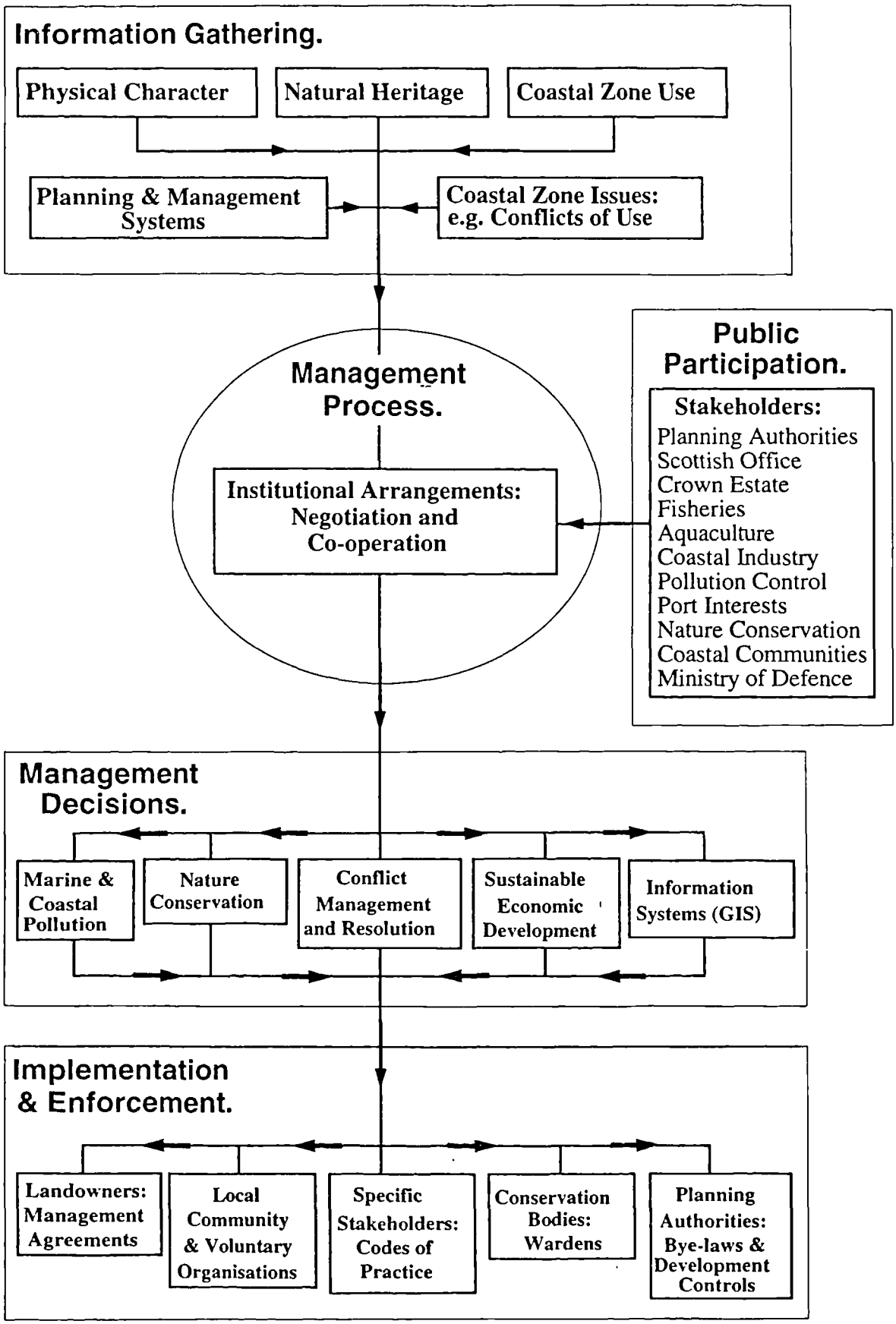
The final stage of the proposed management framework for coastal zone management developed for the thesis was that of 'implementation and enforcement' of the management decisions arising out of the previous stage of the management framework.

At this point the thesis concentrated on one of the main coastal zone issues, that of coastal zone conflicts of use, in an assessment of the ability of the framework for coastal zone management outlined above to address the main management issues of concern within the coastal zone. And, also in an investigation of, as stated previously in Section 1.3, the general presumption that coastal zone management would provide a means of reducing conflicts in this area. Specifically this involved:

- An examination of the strategies and techniques available for conflict management and resolution within the coastal zone.
- An analysis of the application of one of the conflict resolution techniques identified, within the case study area.

Over the page, Figure 1 is a diagrammatic representation of the four stages of the management framework for coastal zone management described above.

Figure 1: Structurally Representative Management Framework for Coastal Zone Management



1.3.3. The Structure of the Thesis.

The chapter format adopted for this thesis reflects the methodological stages expressed in Section 1.3.2 and Figure 1 above. Chapters 2 to 6 represent the coastal zone information gathered concerning the Moray Firth. Specifically, Chapters 2 and 3 examine the coastal resource of the Moray Firth in terms of the abiotic and biotic environments. Together, these provide the structure upon which the use and management of the Moray Firth coastal zone have evolved.

Chapter 4 marks the beginning of survey investigations within the field using specifically designed questionnaires. Chapter 4 examines the uses and users of the Moray Firth coastal zone, while the following chapter, Chapter 5 is an examination of existing land planning and sea use management systems operating within the Moray Firth coastal zone.

Computer generated maps encompass the main points of the information contained in chapters 2 to 5, and includes a map illustrating the spatial conflicts of use within the Moray Firth coastal zone. The findings illustrated on this map, Map 12, are then followed up in Chapter 6 which seeks to identify actual and potential conflicts of use within the Moray Firth coastal zone.

Chapter 7 examines the management processes associated with coastal zone management, and identifies several aims and objectives for the management of the Moray Firth as well as management response options designed to achieve these goals and objectives.

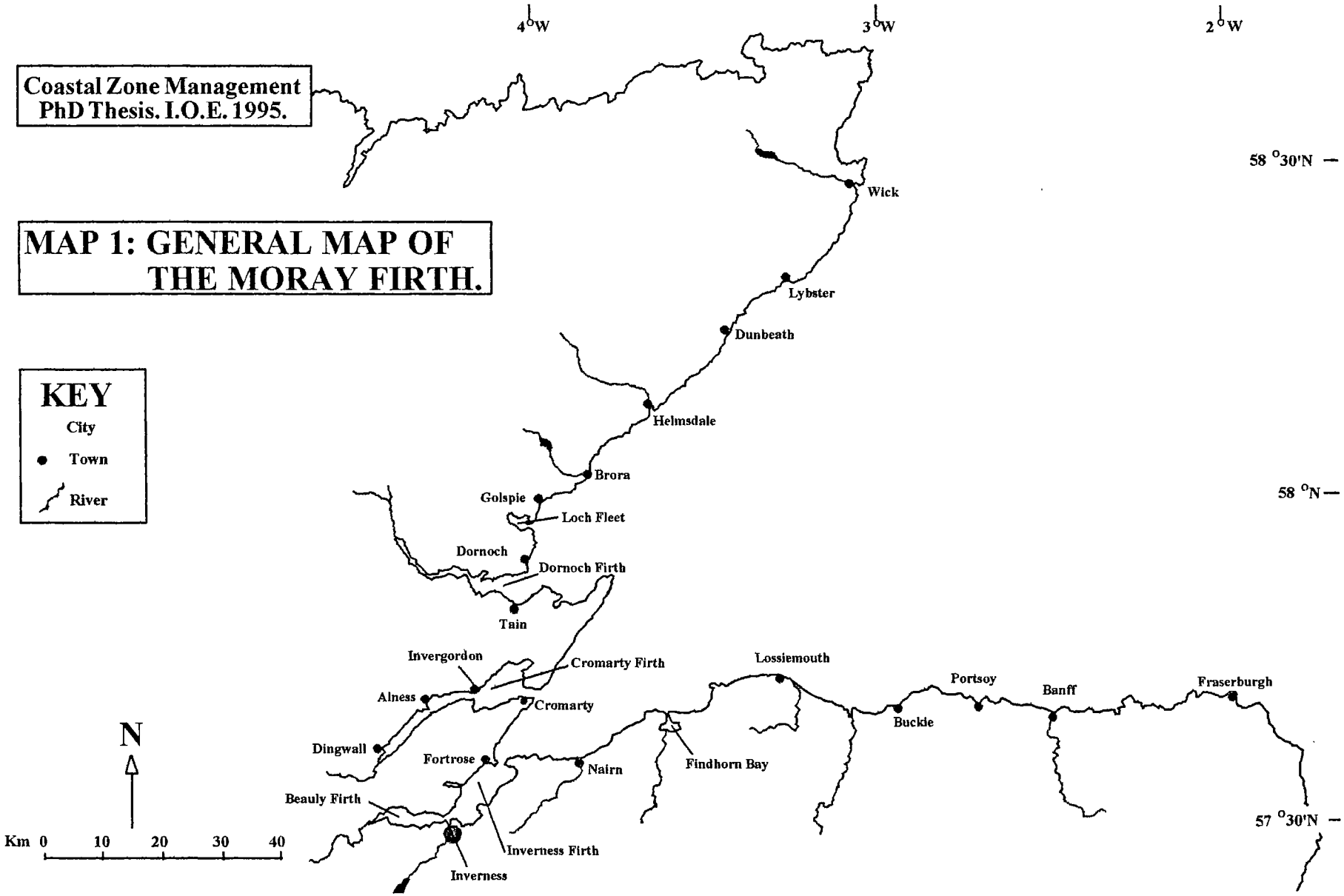
An investigation of the effectiveness of the management response options to achieve the goals and objectives for coastal zone management is then undertaken. Specifically, this is concerned within the importance of public participation within the process of coastal zone management, and an examination of how public participation can be most effectively achieved within the coastal zone of the Moray Firth as part of the wider development of institutional arrangements for coastal zone management. It identifies how Moray Firth coastal zone stakeholder consensus regarding management decisions may be achieved, and implemented, concerning coastal zone issues of concern.

Chapters 8 and 9 are an investigation into the ability of the coastal zone management framework to manage and resolve the coastal issue of conflicts of use within the zone. Specifically, Chapter 8 examines the strategies and techniques available for conflict management and resolution within the coastal zone, while Chapter 9 is an analysis of the ability of a zoning scheme for the Moray Firth coastal zone to control conflicts of use as well as achieve maximum users satisfaction. Methods for enforcement are also identified.

The final chapter, Chapter 10 then presents, in conclusion, a summary of the research in review which considers the main insights gained into the processes associated with management of the coastal zone, the key recommendations to emerge from the study and a final conclusion regarding an assessment of the management framework developed for coastal zone management.

1.4. *Map 1: General Map of the Moray Firth.*

This map shows the basic outline of the Moray Firth, which is then used in the subsequent maps which show far more detail concerning specific activities occurring within the coastal zone of the Moray Firth. Illustrated on this map are the main rivers that flow into the Moray Firth, as well as the main settlements of the coastal zone. This map also pinpoints the positions of; the Dornoch, Cromarty, Inverness and Beauly Firths, as well as Loch Fleet and Findhorn Bay.[9,10]


Coastal Zone Management
PhD Thesis. I.O.E. 1995.
MAP 1: GENERAL MAP OF THE MORAY FIRTH.
KEY
City
Town
River
4°W
3°W
2°W
58 °30'N
58 °N
57 °30'N
Wick
Lybster
Dunbeath
Helmsdale
Brora
Golspie
Loch Fleet
Dornoch
Dornoch Firth
Tain
Invergordon
Cromarty Firth
Alness
Cromarty
Dingwall
Fortrose
Beauly Firth
Nairn
Findhorn Bay
Lossiemouth
Buckie
Portsoy
Banff
Fraserburgh
Inverness Firth
Inverness
N
Km 0 10 20 30 40

Chapter 2: The Abiotic Environment of the Moray Firth.

2.1. *Introduction.*

The abiotic environment forms the foundation upon which the biotic environment is built. The abiotic environment of the Moray Firth is discussed below.

2.2. *Geology and Geomorphology.*

2.2.1. Solid Geology.

Map 2, Section 2.6 illustrates the solid geology of the Moray Firth.

2.2.1.1. *Onshore.*

The onshore geology consists of a metamorphic basement of Dalradian[i] and Moinian[ii] rocks intruded by a series of granitic masses, and unconformably[iii] overlain by Lower, Middle and Upper Old Red Sandstone[iv] deposits of the Orcadian Basin. Mesozoic[v] strata[vi] ranging from Permo-Triassic[vii] to Jurassic[viii] are present along the coastal margins and the only evidence of the Cretaceous[ix] is found as glacial erratics.[11]

The main structural event to affect the area was the Caledonian Orogeny[x] which imposed the fold systems and possible nappe structures[xi] on the Dalradian and Moinian rocks. There is little evidence of major earth movements following this period, apart from

i Dalradian Rocks: Applies to a series of Pre-Cambian metamorphic rocks.

ii Moinian Rocks: A group of metamorphosed Pre-Cambian sedimentary rocks

iii Unconformably: The descriptive word used to describe the relation of rocks in which a sedimentary rock or group of rocks rests on a worn surface of other rocks (sedimentary, igneous or metamorphic). Frequently the plane of uncomformity separates rocks of vastly different ages and the rocks beneath the unconformity are of a more complex structure than those above.

iv Red Sandstone: Sedimentary rocks of Devonian age.

v Mesozoic: Mesozoic era, 65-225 million years ago.

vi Strata: A layer or layers of rock, usually referring to bedded sedimentary rocks.

vii Permo-Triassic: Mesozoic era, Triassic period, 195-225 million years ago.

viii Jurassic: Mesozoic era, Jurassic period, 136-195 million years ago.

ix Cretaceous: Mesozoic era, Cretaceous period, 65-136 million years ago.

x Orogeny: Period of mountain building.

xi Nappe Structure: An overturned fold in which the axial plane is horizontal.

relatively minor faulting[xii] and localised intense folding and thrusting such as that affecting the Lower Old Red Sandstone at Struie.

The Great Glen Fault which resulted from powerful lateral and vertical movements of the rocks, forms one of the main structural features of the area trending north-north-east from Inverness. It forms the basis of the straight coastline as far as Tarbat Ness where it then continues seawards into the Moray Firth.[9] The only other major fault, the Helmsdale Fault, throws down Mesozoic rocks along the northern coast of the Moray Firth against the Old Red Sandstone, Moine and the Helmsdale Granite. In the Lossiemouth region there are two east-west faults throwing down to the south.[11]

The Old Red Sandstone extends from Duncansby Head to the southern shores of the Firth, but there is an outcrop of Triassic sandstone between Burghead and Lossiemouth and to the east of Spey Bay. A succession of mostly metamorphic and igneous rocks extends to Peter Head. There are small outcrops of Jurassic rocks along the fault line which are of considerable geological importance. Jurassic rocks also appear farther north as the result of vertical faulting along a line from Golspie to Helmsdale.

2.2.1.2. *Offshore.*

The occurrence of Mesozoic strata along the coastal region of the Moray Firth led to the suggestion that similar beds might be present offshore, and that the Moray Firth was a large Mesozoic sedimentary basin. This theory was confirmed in the early 1970's as a result of drilling activities by numerous survey teams.

The Mesozoic basin of the Moray Firth seems to have been broadly coincident with the Orcadian basin that existed during Old Red Sandstone times. With the exception of the continental deposits of the Permo-Triassic, the Mesozoic strata were dominantly marine or deltaic, compared with the continental or lacustrine deposits of the Old Red Sandstone. Evidence from the deep seismic records and the marginal nature of the Mesozoic exposed in the coastal region of Brora, indicate that, the limits of this Mesozoic Basin seem to have

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[xii] Faulting: A fracture in the Earth's crust accompanied by displacement of the strata along the fracture line.

extended to just beyond the present day coastline. To the north in the vicinity of Helmsdale, the thickness of Mesozoic strata thrown down by the Helmsdale fault suggests that here the Mesozoic extended much further to the north-west than does the present coast.

The margins of the Moray Firth basin are largely fault controlled, the Mesozoic strata being downfaulted[xiii] against Old Red Sandstone by the Helmsdale fault in the north-west. Along the northern and southern margins major east-west faults, seen as steep gravity gradients north of Fraserburgh and south-east of Wick, downfault the Mesozoic against Old Red Sandstone and Permo-Triassic. The major east-west fault north of Fraserburgh is along the line of a prominent bathymetric deep. These major faults have a minimum downthrow of 500m.

During Permo-Triassic and Jurassic times the main basin was separated by a prominent zone of uplift from a secondary basin to the south. The uplifted area forms a basement high trending east-north-east, west-south-west across the centre of the Firth. It is largely fault controlled being horst like[xiv] in structure. The fact that sediments thin over this zone of uplift and thicken again to the south suggests that sedimentation was also in part fault controlled.

The Mesozoic strata within the basin are broadly conformable[xv] although minor discontinuities exist at the base of the Upper Cretaceous, the base of the Lower Cretaceous, the base of the Upper Jurassic and probably also at the base of the Lower Jurassic. These strata dip uniformly towards the centre of the basin where there thickness increases considerably. Throughout the area the strata are affected by normal faulting to form a series of horst and garben[xvi] structures but have undergone little folding. A major

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xiii Downfaulted: The side of the fracture line that has moved downwards relative to the other.

xiv Horst Like: An upthrown block of rock between two parallel faults.

xv Conformable: Geological strata following in unbrocken sequence.

xvi Garben Structure: A valley which has been formed by the sinking of land between two roughly parallel normal faults.

syncline[xvii] is present along the line of the Great Glen Fault, and in the north-west part of the basin the Lower Cretaceous is folded into gentle anticlinal[xviii] and synclinal flexures. Other folding is generally associated with faulting occurring as drag folds aligned with the major fault trends.[11]

2.2.2. Marine Bottom Sediments.

The sea floor of the Moray Firth mainly consists of Holocene[xix] sediments whose distribution reflects both the glacial history of the area and the present hydrodynamic regime.[12]

The reworking of offshore Pleistocene[xx] deposits is, and has been, the principal source of lithic[xxi] material. A major input of detrital carbonate material is that transported into the area from the Orkney Islands and the Pentland Firth. From a bedload parting zone in the Pentland Firth material is dispersed along routes parallel to tidal flow paths, and carbonate sands move into the central basin and along the north-east Caithness coast. Lithic gravels off the southern coast are derived from the mouth of the River Spey. Coastal erosion is not an important sediment source and fluvial sediment supply is limited to the southern and south-western shores of the inner Moray Firth.

The fluvial sediment input into the Moray Firth has been calculated to be a minimum of 140,000 tonnes annually and may reach as much as 460,000 tonnes a year. However, at least 50% of this material is peat which does not contribute to the mineral matter of the seabed sediments. Much of the fluvial input contributes to major coastal sediment accumulation in such areas as the Cromarty, Dornoch and Beauly Firths, for example,

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xvii Syncline: A trough like fold in the rocks generally resulting from lateral pressure.

xviii Anticline: An arch or upfold in the rocks, generally produced by the bending upwards of the strata under lateral pressure.

xix Holocene: Cainozoic era, Quanternary period, Holocene epoch, recent to 0.01 million years ago.

xx Pleistocene: Cainozoic era, Quanternary period, Pleistocene epoch, 0.01-2 million years ago.

xxi Lithic: Originating from rock or stone.

Holocene silts and silty sands are up to 23m thick in the Cromarty Firth. Offshore deeps which are below the effective wave base also act as sinks for the accumulation of sediments of both a marine and terrestrial nature.

As well as sediment material being deposited within the Moray Firth, some material is also transported out of the Firth via the south-east corner.[9]

The most accessible form of seabed deposits are on the beaches around the Moray Firth, but these are not fully representative of marine material since inshore processes have a major influence on beach composition. The pattern of accretion can also be complicated by the influence of large aeolian[xxii] deposits, such as at Culbin Sands.

2.2.2.1. *Distribution of Sediments.*

Map 3, Section 2.7 illustrates the distribution of seabed sediments within the Moray Firth.

As stated above, these seabed sediments have been formed in an Holocene sedimentary environment and rest either on glacial sediment, post-glacial deposits or on solid rock.

The general trend illustrated by Map 3 is that of coarser sediment in the west and finer sediment in the east, with local variations occurring that are related to topography. The finer details of Map 3 are described below.

Areas of rock outcrops extend locally from the coast, as well as occurring in isolated zones off Brora and Lossiemouth.

Gravel is mainly restricted to small patches close to rock outcrops near the north-western coast of the Moray Firth, this implies that high seabed currents prevent sedimentation of all but the coarsest material. However, a gravely area is present on the southern shore of the Moray Firth in a belt approximately 5-10km wide from the mouth of the River Spey to Fraserburgh. This was penetrated by the British Geological Survey (BGS) borehole number 71/15,[11] where 2m of sub-rounded to well-rounded pebbles of granite, syenite, vein quartz and sandstone were recovered.[12] Small patches of gravel also lie off the Tarbat Ness coast, approximately 10km north-north-east of Balintore and in an area stretching 14km from Helmsdale along the coast to Wick, in a band parallel to the coast.[9]

[xxii] Aeolian: Borne, deposited or produced by the wind.

Sandy gravel occurs in zones up to 15km wide in places although it is absent in the inner most part of the Moray Firth. The carbonate content decreases southwards to about 30% of Helmsdale, where the sorting is poor. The sandy gravels off Buchan are predominantly lithic, with only a 10 to 20% biogenic[xxiii] component. The lithic clasts have a wide range of lithologies some with glacial striae[xxiv] and may be derived either from the erosion of morainic banks or from the River Spey. A tongue of well sorted sandy gravel extends 30km north-eastwards from Rattray Head where strong currents have removed the finer sediments. Sandy gravel also occurs on the 'Smith Bank' (see Section 2.3) where the gravel is predominantly biogenic, although the lithic content increases to more than 50% on its southern flank.

Seaward of the areas of gravel and sandy gravel, sands with more than 1% gravel occur north of 58°N out to 50km from the coast. These gravely sands are rich in biogenic carbonate, typically with values greater than 50%. Gravely sands are present up to 45km east and north-east of Rattray Head, but the carbonate content here is much lower at 10 to 20%. Sediments upon several of the banks are also gravely sands, these have very low carbonate contents (<10%) because they are mainly derived from the winnowing of underlying morainic material which has a carbonate content of less than 10%.

Sand forms the seabed on the flanks of several banks and in much of the inner part of the Moray Firth (see Section 3.1). The sand usually has a low carbonate content of less than 20%, and is moderately well sorted.

Muddy sands are restricted to the southern part of the inner Moray Firth, where water depths are greater than 70m, and the approaches to the inner most Firths. In the inner Moray Firth, the muddy sands are moderately well sorted and contain about 20% carbonate. Visual surveys of the seabed reveal it to be fairly soft, often burrowed and rippled, with uncommon gravel sized shells.[11]

The finest grained seabed sediments, the sandy muds and muds, occur chiefly in the outer Moray Firth (see Section 3.1) where water depths exceed 120m. They are also found in

[xxiii] Biogenic: Originating from living things.

[xxiv] Striae: Minute grooves on the surface of a rock.

isolated deeps nearer shore. The clay mineralogy is dominantly illite (45-60%) with lesser amounts of chlorite (5-25%), montmorillonite (15%) and kaolinite (10-25%).[12]

2.2.3. Coastal Geomorphology.

The combination of geology, past glaciation regimes and present wave and current energy environments have produced a very diverse coastal geomorphology in the Moray Firth, which is still in the process of change.

Map 4, Section 2.8 illustrates the coastal geomorphology of the Moray Firth, a detailed description of which is outlined below, starting in the south-eastern corner of the Firth and working around to the northern tip at Duncansby Head in Caithness.

2.2.3.1. *Rattray Head to Fraserburgh.*

The north-east coast of Buchan contrasts with that immediately to the west. The area is low-lying and windswept, with wide sandy beaches, backed by dunes, occupying much of the coast.[13]

2.2.3.2. *Fraserburgh to Ardersier.*

Once around Kinnaird Head where the fishing port of Fraserburgh stands four-square against the uncompromising North Sea storms, the landscape assumes an altogether different character. The granites and sweeping dune coasts to the east are left behind and ahead lie the glories of the so-called 'Banffshire Riviera'.

Old Red Sandstone occurs along the coast between Fraserburgh and Gardenstown and results in the towering 300ft (90m) cliffs at Troup Head, as well as those at Lions and Pennan Head.[14]

To the west of Gardenstown the wall-like form of the cliffs changes as the Old Red Sandstone gives way to metamorphic rock once more. The irregular character of the next 25 miles (40km) of coastline is due to the rapidly changing and less uniform lithology of the Dalradian rocks.[12] Between Gamrie Bay and the mouth of the River Deveron the precipitous coastal cliffs have coves excavated in the less resistant blue slates and promontories made of the steeply dipping flagstones. However, most of the larger

headlands are carved from almost vertical beds of pebbly grit, especially at Knock Head near to Banff itself.

The pebbly grits, limestone's and flags to the west of Whitehills, produce a coastline of lower elevation. Boyne Bay is carved in an even less resistant limestone which marks the base of the Upper Dalradian succession. Here the line of discontinuity,[xxv] known as the Boyne Lag, is crossed, for the headland of Cowhythe Hill has been carved from Lower Dalradian gneiss.[xxvi] This same rock also forms the craggy cliffs of East Head overlooking Portsoy. Westwards, the rapid alternation of the Durn Hill quartzite[xxvii] and the Sandend dark schists[xxviii] results in the crenullated coastline between Redhythe Point and Garron Point.

The coast now sweeps down to Cullen. Nearby are the 'singing' white sands, whose spherical quartz grains emit a muffled squeak when trodden on, and the prominent quartzite sea stacks of the Three Kings. This is the realm of the tough Cullen quartzite which has been sharply folded into steep anticlines and synclines. This quartzite has created the spectacular Bow Fiddle rock at Portknockie.

As you move westwards into Morayshire, the Dalradian rocks are replaced by those of the Old Red Sandstone and once again this change is reflected in the geomorphology. Except for the New Red Sandstone cliffs between Lossiemouth and Burghead, solid rock is not seen again at the coast until Inverness is reached. The low coastal plateaux of Banffshire is replaced by the sandy bays of Spey, Burghead and Culbin, one of the finest areas in Britain for studying coastlines of deposition.[13]

Beyond the town of Nairn, the ice-sheets that covered the inner recesses of the Moray Firth left remnants of moraines in the landscape, none being more important than those at

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[xxv] Discontinuity: A zone below the Earth's surface that represents a boundary separating parts of the Earth's surface with different physical properties.

[xxvi] Gneiss: A metamorphic rock, crystalline and course grained, somewhat resembling a granite but showing a more or less banded arrangement of its constituents.

[xxvii] Quartzite: A highly siliceous metamorphosed sandstone. Usually very tough.

[xxviii] Schist: A metamorphic rock characterised by the parallel alignment of its constituent minerals.

Ardersier, Alturlie and Kessock. At each of these locations the smooth coast of the Moray Firth is broken by a low headland of unsorted morainic drift. The curving moraine of Ardersier, for example, can be identified as recurring at Chanonry Point on the other side of the Inverness Firth, despite its subsequent mantle of marine deposits.

Such moraine remnants are believed to have been the local equivalent of the so called Perth Readvance glacial stage, but more importantly, they have since provided the natural breakwaters around which the sea has fashioned the remarkable forelands upon which Fort George and Fortrose now stand. These terraced forelands are composed of no less than four raised beaches and represent all the various episodes of wave construction, from late glacial times to the present day. A deep (24 fathoms) tide scoured channel now separates the two points, as waves and tidal currents still work upon the unconsolidated drifts of the Moray Firth to maintain the shape of the two forelands.[13]

2.2.3.3. *Ardersier to Golspie.*

Considering the general linearity of Scotland's eastern coast, the complex interfingering of land and sea represented by the Firths of Beauly, Inverness, Cromarty and Dornoch, is something quite exceptional. These major inlets were formed as a result of the drowning of the estuaries of four major rivers, superimposed from the late Tertiary[xxix] upland surface and deeply incised into the underlying structures by rejuvenation.[xxx] Around these Firths there is a landscape of low sandy shorelines, with extensive raised-beach remnants that cut into the thick mantle of glacio-fluvial deposits and reddish-brown boulder clay.

Interesting landscape features along this coastline include; Monlochy Bay, which is cut into the Black Isle between the Firths of Inverness and Cromarty, the sheer cliffs called the Sutors of Cromarty that flank the present entrance to the Cromarty Firth, and the remarkable straightness of the coastline between Tarbat Ness and Fortrose which is clearly related to the submarine extension of the Great Glen Fault. Finally, the shallow waters of

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[xxix] Tertiary: Cainozoic era, Tertiary period, 2-65 million years ago.

[xxx] Rejuvenation: An increase in erosive activity as a result of an increase in the hieght of the surrounding land.

the Dornoch Firth are flanked by an interesting suite of coastal spits and forelands, some of which were initially fashioned during the higher sea levels of the post-glacial transgression when tidal waters temporarily linked Dornoch Firth with Nigg Bay. Since then, the sandy foreland of Morrich More near Tain, has grown outwards into the Firth as the sea level has slowly fallen. This has happened through the successive addition of sandy barriers thrown up by wave action on Whiteness Sands.[13]

The final marine inlet on this eastern coastline is Loch Fleet, which causes a deviation of the coastline between Dornoch and Golspie. Originally an open loch at the seaward end of the deeply incised Strath Fleet, the loch has been almost cut off from the North Sea by the gradual growth of spits from both the northern and southern shores. Like most of the other constructional coastal landforms around the Moray Firth, these beach ridges appear to have been fashioned largely by waves of post-glacial raised beach age. Today, its pine woods, shingle ridges and sheltered waters constitute an important nature reserve (see Section 3.3.1).

2.2.3.4. *Golspie to Helmsdale.*

Between Golspie and Brora the coastal strip is narrow, providing a corridor on which both roads and rail tracks have been laid on raised beaches and associated glacial debris. The immediate backing to the shore is low, the intertidal being rocky, interspersed with patches of wave-washed sand and pebbles. Towards Helmsdale the coastal plain peters out where the bounding fault of the Mesozoic sedimentary basin runs out to sea. Granite hills now hug the shore and cliffs replace the beaches of the Brora lowland.[13]

2.2.3.5. *Helmsdale to Duncansby Head.*

The land rises between Helmsdale and Wick, and much of the coast is backed by high cliffs which make the shore difficult to access from the land. Some of the highest ground within the Moray Firth is located on the Sutherland and Caithness border, where granite rocks approach the coast. There are important sea bird nesting sites on these cliffs.

To the north of Wick and the south of Skirza the shores are backed by the low-lying plains of eastern Caithness. There is an extensive sandy beach, backed by dunes in Sinclair's Bay

and another smaller beach in Freswick Bay. Elsewhere there are cliffs of low to moderate height, with some rocky reefs situated intertidally, as at Tang Head and south of Noss Head.

North from Skirza to Duncansby Head the coast is backed by magnificent cliffs of middle Devonian sandstone, with associated stacks and geos. The sandstone is almost horizontally bedded, providing important nesting sites on the cliffs for many sea birds, for example, fulmar (*Fulmarus glacialis*), razorbill (*Alca torda*), guillemot (*Uria aalge*) and kittiewake (*Rissa tridactyla*).

2.3. *Bathymetry.*

Map 5, Section 2.9 illustrates the bathymetry of the Moray Firth.

Within the inner parts of the Moray Firth the sea floor slopes gently away from the coast to a depth of about 50m (all depths corrected to Ordnance Datum (OD) Newlyn). Here the coastline is regular and the sea floor correspondingly even. A channel of deeper water is present in this western area, reaching a maximum depth of 70m and extending north-east from Inverness to north of Lossiemouth. This feature represents the seaward continuation of the valley formed by the rivers Beauly and Ness.

In the coastal regions between Fraserburgh and Buckie, and between Helmsdale and Duncansby Head, the sea floor slopes away from the coast for a distance of 5-10km to an average depth of 60m below OD. The rugged coastline of these areas is reflected in the very uneven and irregular sea floor topography immediately offshore.

The most prominent bathymetric features of the Moray Firth are a series of east-west deeps in the south-east part of the region between 57°40'N and 58°5'N. The southern most deep, located some 10km off the Banff coast, called the 'Southern Trench', is the most significant, reaching a maximum depth of 250m. This deep extends for over 75km, trending east-west between Banff and Fraserburgh and swinging east-north-east to the north-east of Fraserburgh. At its widest extent north-west of Fraserburgh, a prominent central east-west ridge is present, reaching up to 40m below OD and extending for a distance of 12km. The more northerly deeps are less prominent features attaining depths of 100-120m. The origin

of the deeps is not known for certain, however, they may be associated with the release of glacial melt water, or with major bed rock faulting.[12]

The central Moray Firth has an average depth of 50-60m and shows little topographic variation. Any variations in relief that do exist consist of gently undulating banks such as the 'Smith Bank', centred about 2°50'W and 58°10'N, which rises to a depth of 40m below OD and covers an area of about 150km^2. A north-north-east by south-south-west trough of deeper water separates the bank from the coastal region. Other raised banks in the Moray Firth include the 'West Bank' in the eastern offshore area of the Moray Firth and the 'Bosie Bank' at the approaches to the Firth.[9]

The sea floor to the north and north-east of the central Moray Firth dips gently towards the east to a depth of some 100m. The relatively smooth seabed in this region is characterised by the absence of significant bathymetric features, with the exception of the area immediately offshore from Wick and Duncansby Head where there is a series of prominent banks. The largest, which lies to the east-north-east of Duncansby Head, reaches a height of 30m below OD in contrast to an average depth of over 70m for the surrounding seabed.[11]

2.4. *Hydrography.*

Hydrographic parameters of an environment are important in assessing the environmental sensitivity of an area. They can control the distribution of biota particularly phytoplankton and zooplankton, influence the distribution of pollutants, limit the uses that can take place and influence the action that can be taken when environmental protection is required.[15]

2.4.1. Water Circulation.

The Moray Firth embayment lies within the north British coastal area of the North Sea, it is composed of Scottish coastal waters and mixed waters of both coastal and oceanic origin transported by local currents from the Fair Isle Current.[15] The 35.0‰ (parts per thousand) isohaline, which runs across the approaches to the Moray Firth, offers a boundary between the Firth and the offshore northern North Sea.[9]

The Fair Isle Current composed of 'mixed' waters enters the North Sea between Orkney and Shetland. Its position is not constrained by bathymetry in this area but by conditions

of temperature and salinity. It may, therefore, vary both within and between years but is confined to a narrow zone. In summer, cold bottom water in deeper offshore areas ensures a strong offshore density gradient and confines the current, but in the winter flow is less well defined. After entering the North Sea, the Fair Isle Current flows south-east across the approaches to the Moray Firth and then travels east following the 100m depth contour at approximately 57°30'N.

Shoreward of the Fair Isle Current, local currents transport water into the Moray Firth from off the north coast of Scotland. Surface waters entering the Moray Firth circulate around the 'Smith Bank' and a central cell of motion is largely separated from more coastal waters. A bottom clockwise eddy occurs within the Moray Firth, bounded in the north by 58°30'N, the east by 2°00'W, in the south by the 'Southern Trench', and the west by 3°30'W. The outer circumference of the eddy has been calculated at approximately 120 miles, with an average speed of one mile a day and thus one complete circulation occurs every 120 days.[9]

The tidal streams in the Moray Firth are variable in direction and strength at different stages of the tidal cycle. As the tidal wave passes across the entrance of the Firth (as opposed to being directed into it) the tidal streams are generally weak in the inner Firth where circulation is dominated by local gyres, the outer Firth however experiences stronger tidal streams.[15] The spring tide range is between 3.0-3.5m along most of the Moray Firth coast, however, the east coast of Caithness has a slightly smaller range, this can be seen in Table 1 below.

Table 1 : Tidal Ranges in the Moray Firth : Figures in m.[16]

Sites	Mean Springs	Mean Neaps
Wick	2.9m	1.3m
Golspie	3.4m	1.6m
Cromarty	3.5m	1.7m
Inverness	3.1m	1.9m
Nairn	3.6m	1.7m
Banff	3.1m	1.7m
Fraserburgh	3.3m	1.6m

The topography of the coastline along the southern shore of the Moray Firth induces unusual tidal patterns, such as those that operate locally from Cullen to Kinnaird Head, extending offshore for about 8 miles. An easterly flow exists for 9 hours on each tidal cycle and an insignificant flow for the remaining 3 hours. The flood tide current is deflected as it approaches the southern coast while the area is 'sheltered' from a north flowing ebb current to the north because of the curvature of the coastline beyond Kinnaird Head.[9] The residual tidal effect is therefore an eastward flow along the southern shore of the outer Firth and a clockwise circulation in the inner Firth.

Wind and waves are critical energy input sources and data suggests a complex distribution of wave height and direction with both locally generated waves in addition to swell waves generated outside the Moray Firth. Wind driven residual currents occur mainly in the winter months and are superimposed upon tidal streams and their associated residual currents.[9]

2.4.2. Sea Temperature.

Sea temperatures are intermediate between those of the west coast of Scotland and the more extreme conditions of the central and southern North Sea. Within the Moray Firth itself, there is some gradation of conditions so that the range of sea temperatures in the inner Firth is greater than in the outer Firth.

In winter, the water is completely mixed and stratification occurs only along the southern coast where the less saline cooler surface waters from land run-off are 0.5°C-1.5°C colder than bottom waters. During the summer the temperature stratification becomes more widespread due to delayed warming of deeper waters, and the land run-off along the southern coast being warmer than the northern waters.[15]

An area of colder water lies across the approaches to the Moray Firth and is associated with strong tidal mixing of the water entering the North Sea between Orkney and Shetland together with further tidal mixing taking place off the north-east of Buchan.[9]

Figure 2 shows monthly charts of the near surface (7.5m) sea temperature distribution in the Moray Firth throughout a typical year.

2.4.3. Salinity.

Within the Moray Firth there is an increasing salinity gradient from south-west to north-east in both surface and bottom waters, ranging from about 31.5‰ (parts per thousand) in the inner most parts to 35.0‰ in the outer Firth.[15] The bottom water is always more saline but the salinity gradient from the surface to bottom layers is normally small, except where the surface salinity is lowered due to seasonal freshwater run-off.[9]

Although rainfall in the Moray Firth is low, the rivers draining to this coast flow from mountainous areas where rainfall is very much higher. Therefore, it follows that the salinity in the Firths and inlets may be greatly modified following heavy rainfall or the melting of snow cover.

As with temperature, a belt of low salinity coastal water exists in the inner Firth and along its southern shore. Between January and June, this belt may well extend out into the outer Moray Firth, however, later in the year it mixes with incoming water of higher salinity.[9]

Figure 3 shows monthly charts of the near surface (7.5m) sea salinity distribution in the Moray Firth throughout a typical year.

Figure 2: Monthly Charts of the Near Surface (7.5m) Sea Temperature Distribution in the Moray Firth.[17]

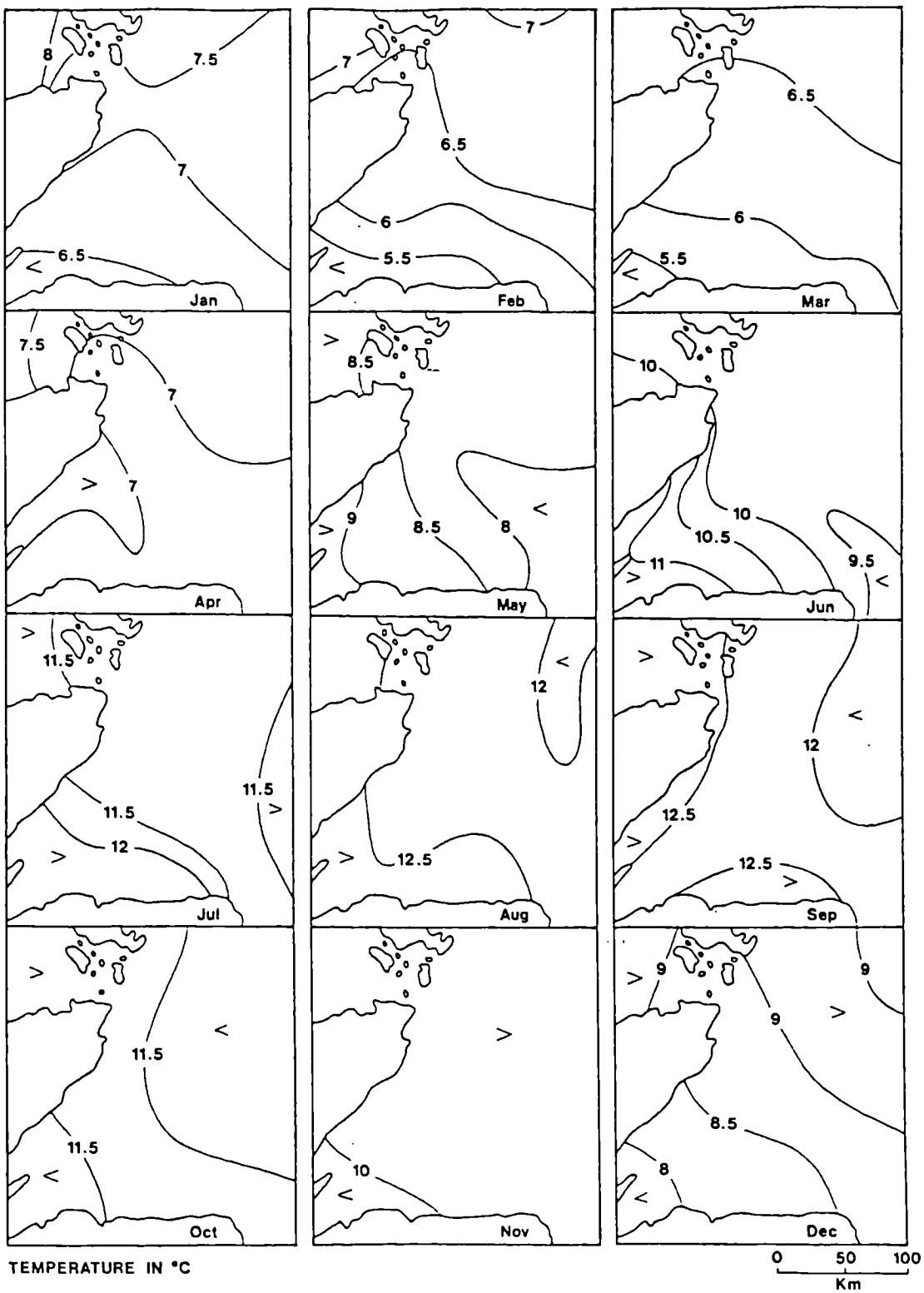
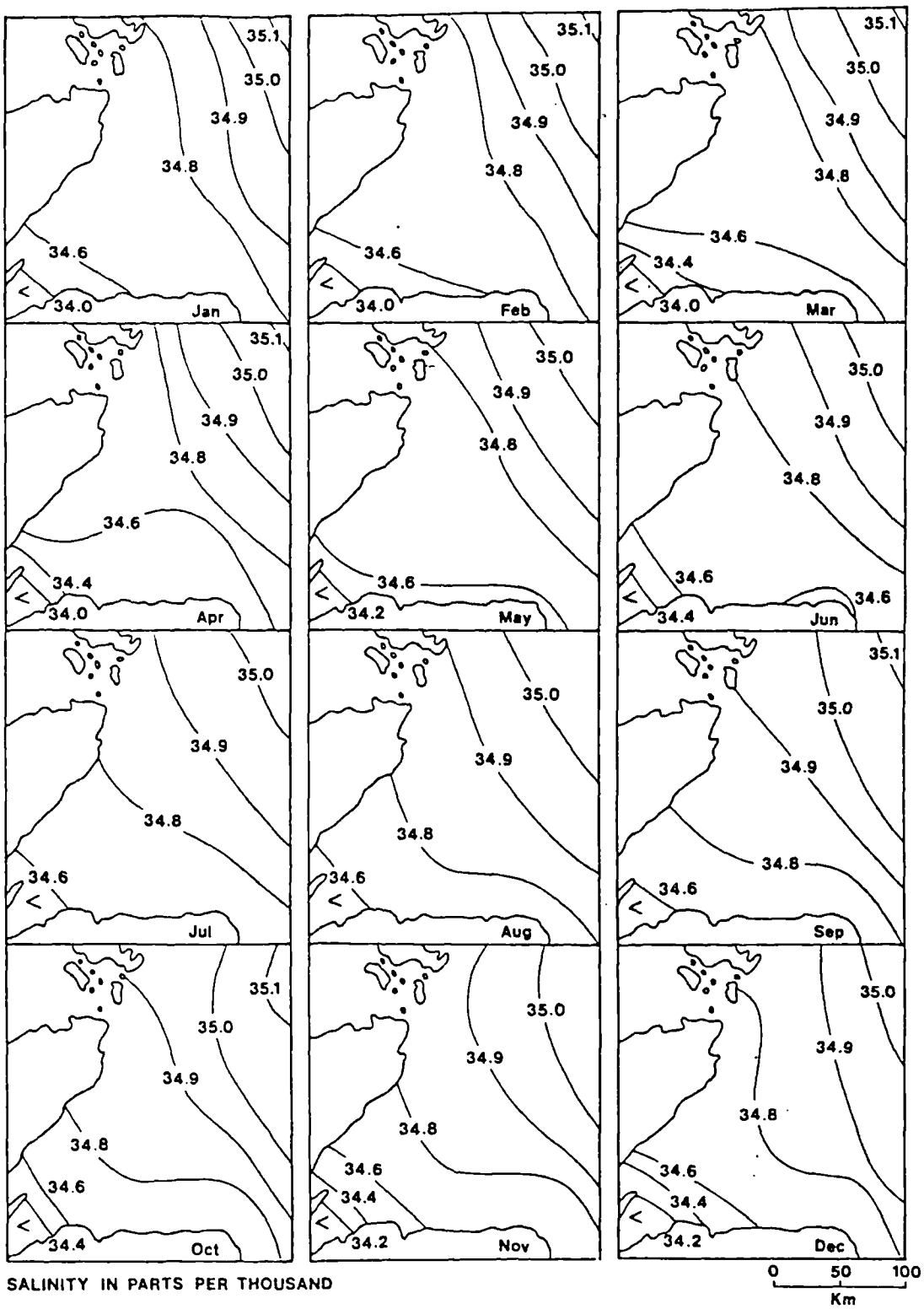


Figure 3: Monthly Charts of the Near Surface (7.5m) Sea Salinity Distribution in the Moray Firth.[17]



2.4.4. Fresh Water Inputs.

As stated previously, fresh water input into the Moray Firth affects both the temperature and salinity of the sea water within the confines of the Moray Firth. This is particularly true of the inner reaches of the Dornoch, Cromarty, Beauly and Inverness Firths, Loch Fleet and the southern coast of the Moray Firth.

Sediment input from the rivers mentioned in Table 2, when compared with other sources is negligible at present, with the possible exception of the River Spey which is Scotland's fastest flowing river. This river has sufficient energy to carry coarse material from the uplands, but where the gradient slackens near sea level this load is dumped, to be worked by stream currents into numerous islands or by waves into shingle spits along the coast.[13] Table 2 shows the fresh water inputs into the Moray Firth from each District.

Table 2: Fresh Water Inputs into the Moray Firth.[10]

District	River / Burn
Caithness District	Gill Burn, Burn of Lyth, Wick River, Reisgill Burn, Burn of Houstry, Dunbeath Water, Berriedale Water and Longwell Water.
Sutherland District	River Helmsdale, Brora Burn, Golspie Burn, River Fleet, River Shin, River Evelix, and the River Carron.
Ross & Cromarty District	Wester Fearn Burn, East Fearn Burn, River Averon, River Glass, River Sgitheach, River Conon, and the River Beauly.
Inverness District	The River Ness.
Nairn District	The River Nairn.
Moray District	River Findhorn, River Lossie, and the River Spey.
Banff & Buchan District	Burn of Boyne, and the River Deveron.

2.5. *Meteorology.*

The climate of the Moray Firth is well favoured considering its northerly latitude. The area lies in the 'rain shadow' of the Highlands, so that rainfall is exceptionally low, and the number of sunshine hours correspondingly high, while the proximity of the North Sea prevents coastal temperatures from being very low during the winter months.

There is a distinct range of climate along the coast which is dependent to a large extent on the degree of shelter to winds from the north and east. The sheltered inner Moray Firth

area from Dornoch in the north to Elgin on the southern coast, including the Black Isle, has a relatively genial climate. North of Dornoch and east of Elgin the climate becomes more rigorous due to increasing exposure to wind.[9]

2.5.1. Precipitation.

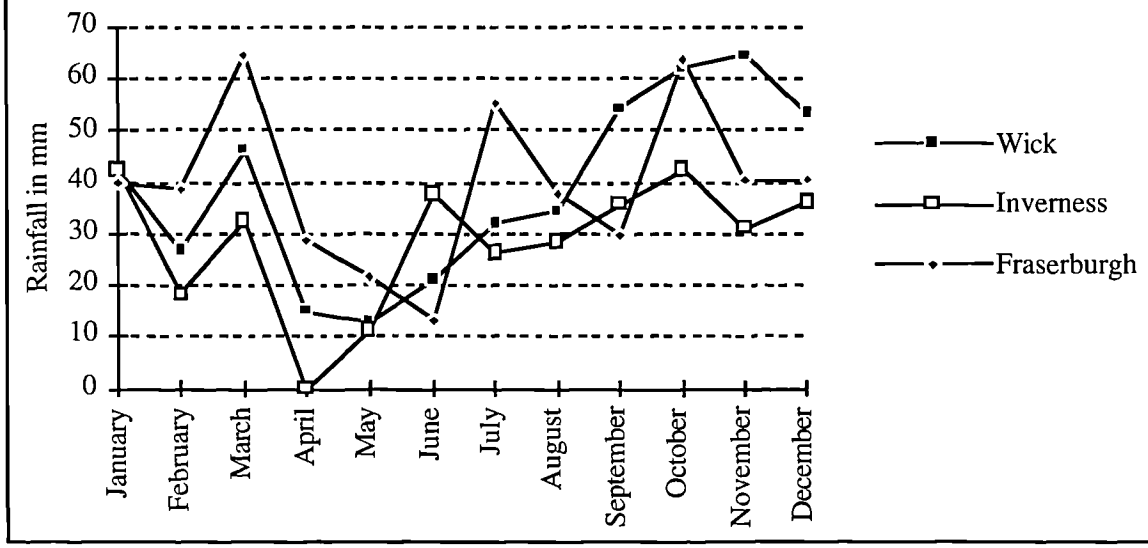
There are a number of aspects of Scotland's climate which are not generally well known or understood, but perhaps the main misconception is that the whole of the country suffers from very high rainfall.[18] Many districts especially in the north east of Scotland, have on average over the four summer months of May, June, July and August, a total rainfall of less than 250mm. This compares closely with the total rainfall for these same months in the drier parts of England. This can be seen in Table 3 below. In fact, Tarbat Ness on the Moray Firth, is one of the driest weather stations in the country, with an average annual rainfall of only 560mm. Within the rest of the Moray Firth, totals increase to the north-east and south-east but remain relatively low all around the coast. This phenomenon is shown in Chart 1, where the variation in mean monthly rainfall from 1980-91 between Wick in the north-east, Inverness in the south-west and Fraserburgh in the south-east is expressed. Here all values are plotted against the lowest monthly rainfall recording, which was 29.8mm for April at Inverness, on the chart this value is expressed as 0mm. The chart shows clearly that a proportionately higher amount of rain falls north-east and south-east of Inverness which lies in the sheltered inner Moray Firth, and has a more favourable climate than either of the extremities of the outer Moray Firth.

Table 3 : Annual Rainfall for Selected Sites within the Moray Firth : Figures in mm.

Sites	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
I	872	946	840	727	913	1000	735	907	813	604	834	722
II	-	-	-	-	758	857	787	667	971	810	1167	797
III	777	621	712	650	560	715	614	606	790	622	1025	660
IV	770	568	580	491	532	685	503	613	697	526	795	501
V	795	657	686	559	691	783	540	635	712	503	817	523
VI	735	603	707	525	683	795	565	662	717	487	723	589
VII	792	652	623	583	730	830	650	714	674	508	742	595

Sites: I = Wick Airport; II = Dingwall; III = Inverness; IV = Nairn; V = Forres; VI = Lossiemouth Airport; VII = Banff Golf Course. Source: **19**

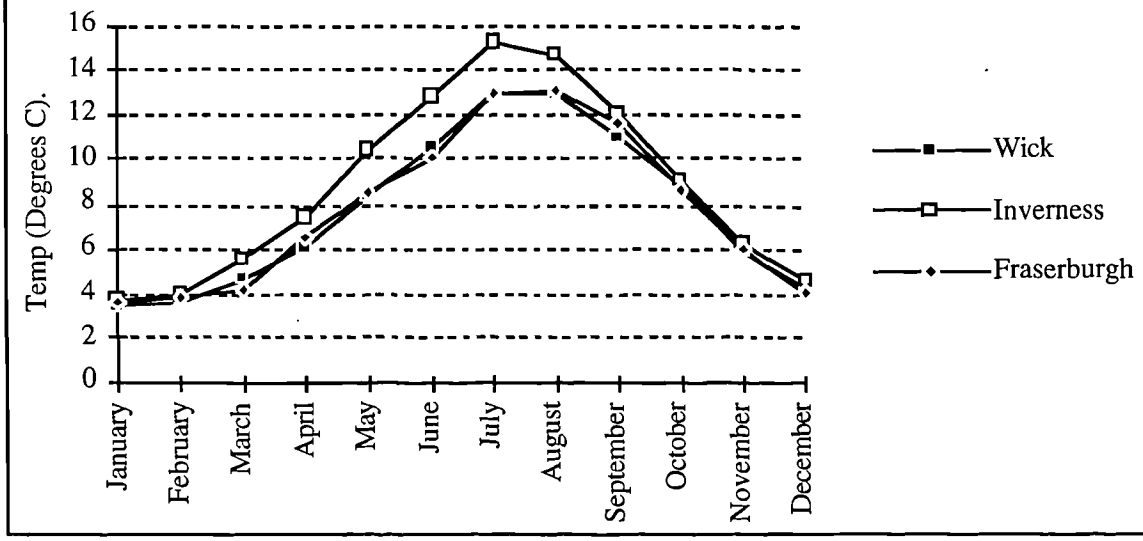
Chart 1: Variation in Monthly Mean Rainfall (1980-91).



2.5.2. Temperature.

Within the Moray Firth there is little variation in air temperature with latitude, although the inner parts of the Firth, as described previously, have a slightly warmer climate than the extremities. This is illustrated by Chart 2.

Chart 2: Monthly Mean Temperatures (1980-91).



Within the Moray Firth as a whole, May and June are the sunniest months. It should also be noted that, on average, April is more sunny than the major holiday months of July and August where there is a marked fall in mean daily sunshine from the early summer values.

2.5.3. Wind.

A 'day with gale' is defined as one on which the mean wind at the standard measuring height of 10m above the ground attains a value of 34 knots (39 miles per hour, 17.2 metres per second) or more, over any period of 10 minutes during the 24 hours.[18]

Within the Moray Firth, wind strength varies from north to south, with the inner Moray Firth to some extent sheltered from prevailing south-westerlies by the Highlands. This can be seen in Table 4, where sites within the inner Firth have far fewer days with gale than those within the outer Firth.

An interesting point to note is that on the 13th of February 1989 at Fraserburgh (far south east of the outer Moray Firth) a gust of 123 knots (142 miles per hour, 63 metres per second) was recorded. This was the highest gust ever recorded at a low level site in the UK.

Table 4 : Annual Number of 'Days with Gale' for Selected Sites Around the Moray Firth.[19]

Sites	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
I	8	13	6	16	10	6	9	3	14	14	20	13
II	-	-	-	-	-	0	4	0	2	5	8	4
III	0	0	1	0	1	0	0	0	0	0	1	0
IV	6	12	4	9	7	6	6	1	7	3	5	0
V	47	38	36	57	40	26	40	26	-	3	4	2
VI	25	36	22	33	28	21	20	21	32	14	-	-

Sites: I = Wick Airport; II = Invergordon Harbour; III = Inverness; IV = Lossiemouth Airport; V = Banff Golf Course; VI = Fraserburgh.

The coast of the Moray Firth exhibits an interesting weather effect, the 'fohn' winds, which are very important in shaping the favourable climate of the area. When moist south-westerly winds pass over the high ground of central and northern Scotland they give rise to the 'fohn' effect by depositing most of their moisture over the high ground, then warming and becoming drier on their descent on leeward slopes towards the Moray Firth coast. Some of the highest UK winter temperatures have been recorded in the Moray Firth as a result of the 'fohn' effect.[9]

2.5.4. Visibility.

Generally, Scotland enjoys remarkably good visibility since the greater part of the country is remote from the industrial and populous areas of Britain and continental Europe. However, the Moray Firth and Northern Isles can suffer from poor visibility as a result of sea fog from the North Sea, which is known locally as 'haar'. Haar occurs from time to time from April to September and can ruin what would otherwise be a brilliantly fine day. Fortunately the haar does not usually penetrate very far from the coast and it tends to break up inland during the day.[18]

2.6. *Map 2: Solid Geology of the Moray Firth.*

Map 2 illustrates the onshore and offshore geology that forms the present day structure of the Moray Firth. Also illustrated are the mainly north-north-east trending faults, such as the Great Glen Fault, which have influenced those rocks of a Devonian[xxxi] age and earlier.[9,,11,12]

2.7. *Map 3: Seabed Sediments of the Moray Firth.*

The relatively thin, uniform cover of bottom sediments that rest on top of the solid geology are illustrated on Map 3. The distribution of the sediments shown reflects glacial history, as well as the present hydrodynamic regime.[9,,11,12]

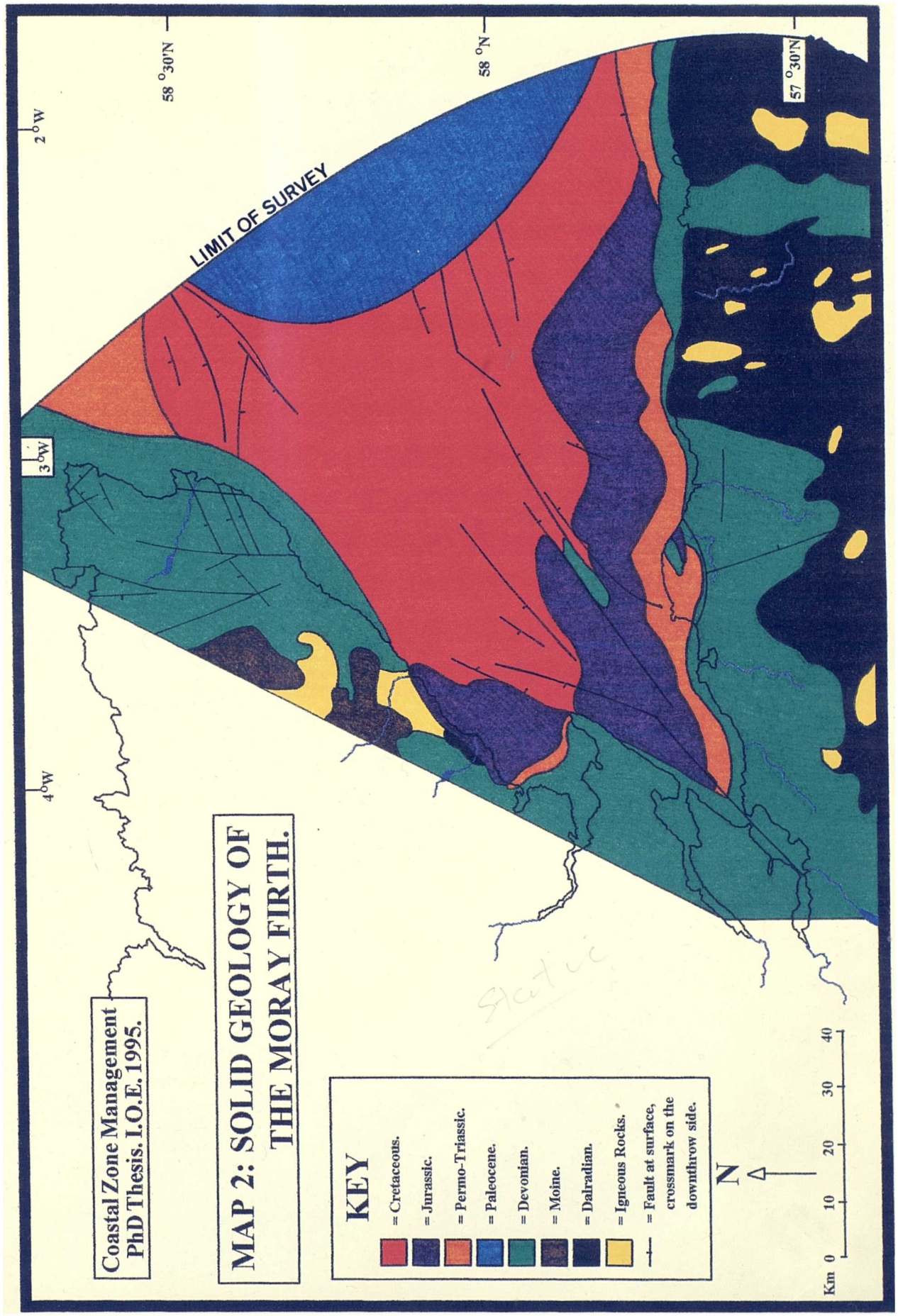
2.8. *Map 4: Coastal Geomorphology.*

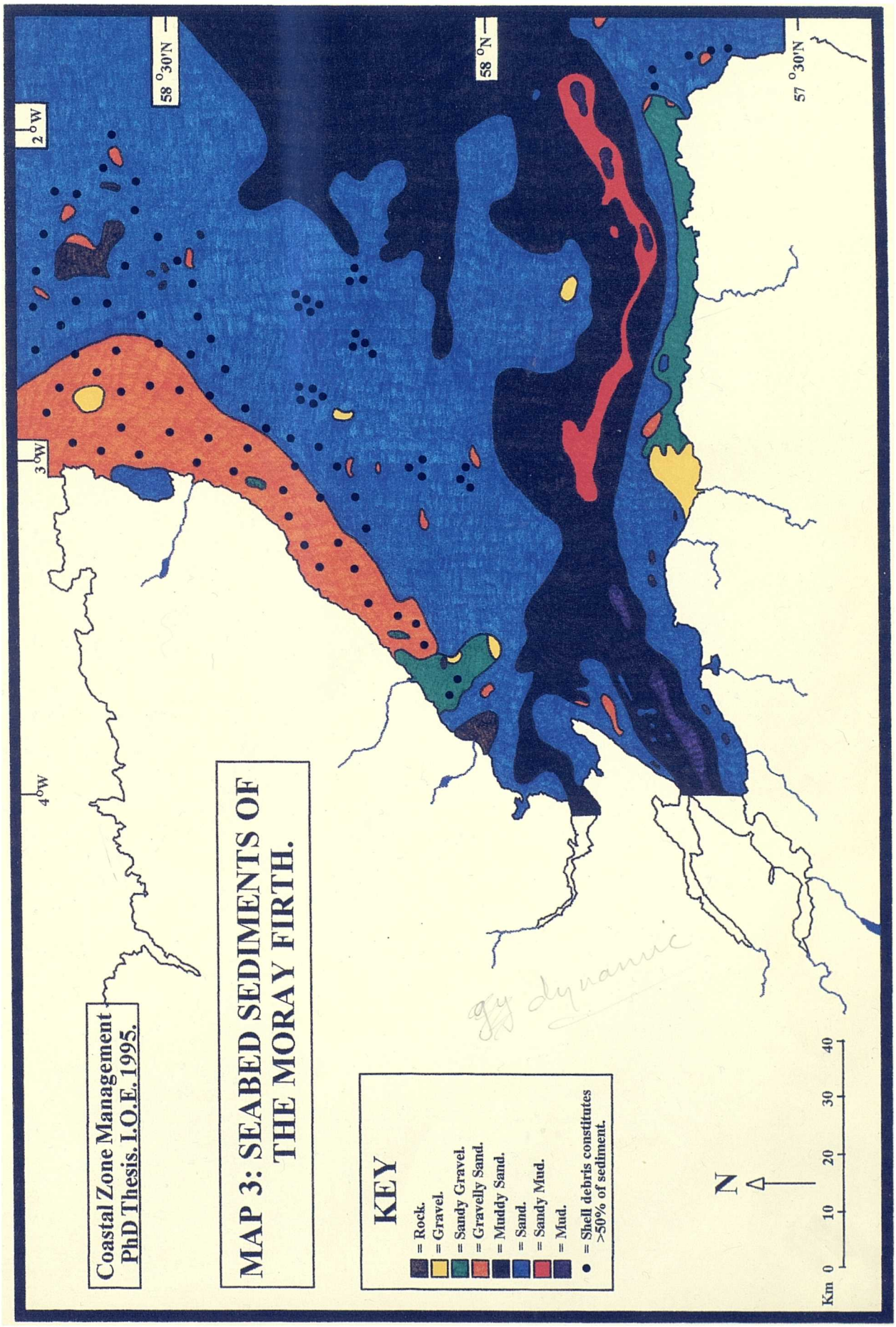
The combination of geology, past glaciation regimes and present wave and current energy environments have produced a very diverse coastal physiography which is still in the process of change. The current situation is illustrated on Map 4, pinpointing such features as; spits, offshore bars, raised beaches, stacks, geos, caves and fossil cliff lines.[9,,11,12]

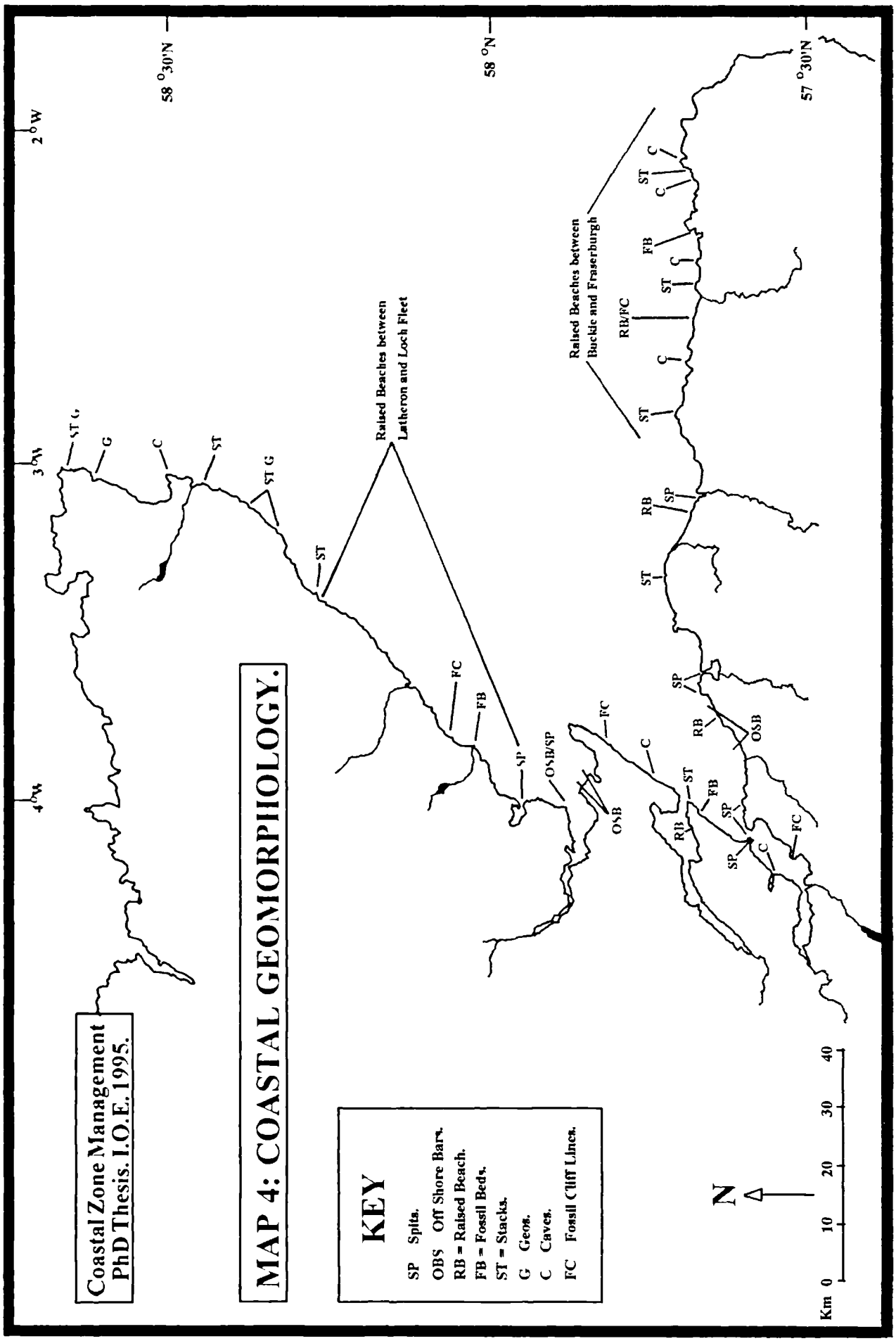
2.9. *Map 5: Bathymetry of the Moray Firth.*

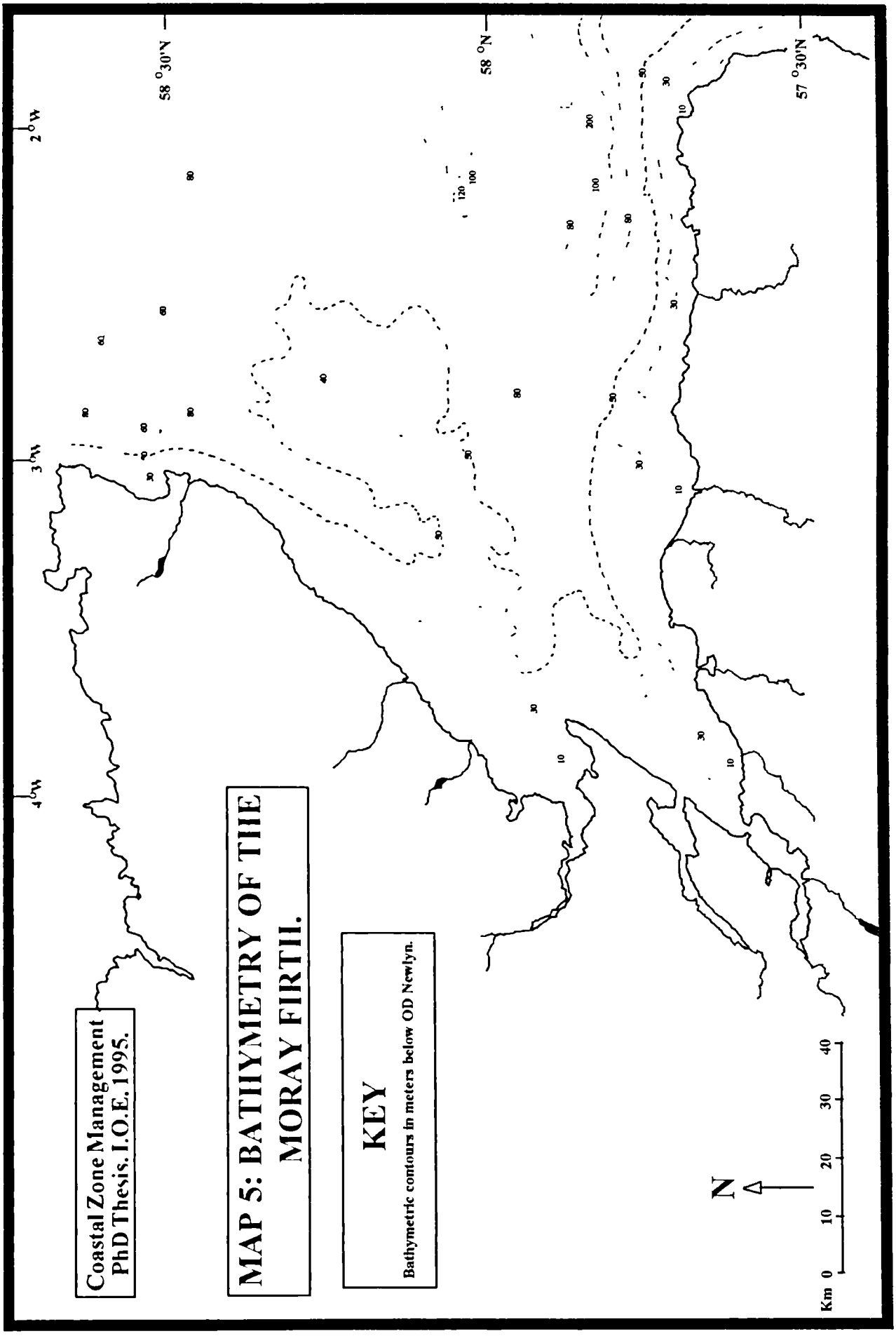
This map illustrates the benthic contours of the Moray Firth in meters below OD Newlyn. Contours have been indicated showing depths of; 10, 30, 50, 60, 80, 100, 120 and 200 meters.[9,17]

[xxxi] Devonian: Palaeozoic era, Devonian period, 345-395 million years ago.


MAP 2: SOLID GEOLOGY OF THE MORAY FIRTH.
Coastal Zone Management
PhD Thesis. I.O.E. 1995.
KEY
= Cretaceous.
= Jurassic.
= Permo-Triassic.
= Paleocene.
= Devonian.
= Moine.
= Dalradian.
= Igneous Rocks.
= Fault at surface, crossmark on the downthrow side.
N
Km 0 10 20 30 40
LIMIT OF SURVEY
2°W
3°W
4°W
58°30'N
58°N
57°30'N


Coastal Zone Management
PhD Thesis. I.O.E. 1995.
MAP 3: SEABED SEDIMENTS OF THE MORAY FIRTH.
KEY
= Rock.
= Gravel.
= Sandy Gravel.
= Gravelly Sand.
= Muddy Sand.
= Sand.
= Sandy Mud.
= Mud.
• = Shell debris constitutes >50% of sediment.
N
Km 0 10 20 30 40
4°W
3°W
2°W
58 °30'N
58 °N
57 °30'N


MAP 4: COASTAL GEOMORPHOLOGY.
Coastal Zone Management
PhD Thesis. I.O.E. 1995.
KEY
SP Spits.
OBS Off Shore Bars.
RB = Raised Beach.
FB = Fossil Beds.
ST = Stacks.
G Geos.
C Caves.
FC Fossil Cliff Lines.
Raised Beaches between Latheron and Loch Fleet
Raised Beaches between Buckie and Fraserburgh
RB/FC
58 °30'N
58 °N
57 °30'N
2 °W
3 °W
4 °W
N
Km 0 10 20 30 40


58 °30'N
58 °N
57 °30'N
2 °W
3 °W
4 °W
MAP 5: BATHYMETRY OF THE MORAY FIRTH.
Coastal Zone Management PhD Thesis. I.O.E. 1995.
KEY
Bathymetric contours in meters below OD Newlyn.
N
0 10 20 30 40
Km

Chapter 3: The Biotic Environment of the Moray Firth.

3.1 *Introduction.*

It can be said that the biotic environment 'determines' to a varying degree the possibilities and opportunities open to man within the coastal zone and, that man, by his use and management of the coastal zone 'determines' the present condition and future state of the resource. A description of the biotic environment is therefore essential as its distinctive parts influence man's use and therefore determines management.

An understanding of the biotic environment is also important since many of the problems at the coast stem from an inadequate understanding or misguided perception, of the biotic environment. In particular, the coast tends to be managed as a static system rather than a particularly dynamic one. The creation and dissemination of an image of the coast more in tune with the environmental reality must therefore comprise a major part of any proposed management of the coastal zone.[20]

The biotic environment also provides the datum against which man's activities within the coastal zone can be measured. Thus there is a need for an environmental inventory and the monitoring of change.

The biotic environment of the Moray Firth can be divided into three identifiable parts which are generally termed the inner, middle and outer Firths. Specifically these areas are categorised as follows:

- The inner Firth is defined as stretching between Dornoch Point on the northern flank and Ardersier on the southern flank. This encompasses the convoluted coastlines of the Cromarty, Dornoch, Inverness and Beauly Firths.
- The middle Firth is defined as stretching between Dornoch Point and Helmsdale on the northern flank and between Ardersier and Lossiemouth on the southern flank.
- The outer Firth is defined as stretching from Helmsdale to Duncansby Head on the northern flank and from Lossiemouth to Rattray Head on the southern flank of the Moray Firth.[14]

For each of these areas a review of the main sectors of the biotic environment has been undertaken. These sectors consist of; site description, benthic environment, ornithology, and marine mammals. However, due to a lack of specific information, most matters concerning the pelagic environment have been examined primarily within the contexts of the outer Moray Firth.

Maps 6 and 7, concerning key coastal ecosystems and critical habitats for wildlife within the Moray Firth, Sections 3.6 and 3.7 illustrate many of the observations that are made in the discussion that follows. In addition, Appendix 1 provides a list of the species mentioned in the text.[9, 21, 22, 23, 24, 25, 26, 27, 28]

3.2. *The Inner Moray Firth.*

3.2.1. The Cromarty Firth.

The Cromarty Firth is a moderately large estuary covering over 12,500 hectares in area and is classed by Scottish Natural Heritage (SNH) as a Site of Special Scientific Interest (SSSI). The Firth itself is situated between Dornoch Firth to the north and Beauly Firth to the south, and to the west lies the Ben Wyvis National Nature Reserve (5,673 hectares), containing the only major mountain massif in the north-east Highlands.[29]

The entrance to the Firth is relatively narrow and leads to a fine deep water channel. From the Sutors which dominate the entrance, the cliffs fall away to form the sides of a narrow trench, providing the deep water channel which reaches almost to Alness Bay. To the north and south of the channel lie the wide shallow bays of Nigg and Udale which, together with the inner bays at Alness and Dingwall, comprise over 3,000 hectares of tidal sand and mud flats. These bays are rich in invertebrates and plants which feed the over wintering waders and wildfowl that congregate in the Firth. It is the size of the intertidal area provided by the above bays, in association with the available food and shelter, which have made the Cromarty Firth so important to ornithologists. Indeed, on the basis of the total numbers of wintering ducks, geese and swans, the Firth is amongst the top sites in Britain, it is also one of the most important estuaries in Scotland in terms of wader numbers.[30]

Of the Moray Firth coastal units, the Cromarty Firth is the most ornithologically outstanding, none of the other Firths compare with it in terms of the area and density of the important food plants for wildfowl such as; eelgrass (*Zostera* spp.), glasswort (*Salicornia europaea*) and tassel pondweed (*Ruppia maritima*), although the Dornoch and Beauly Firths have smaller areas of similar quality. Equally, the large expanse of intertidal flats in the Cromarty Firth contain the largest stocks of invertebrates, the main food source for over wintering waders. These two factors, along with the added factor of shelter, are the basic reasons for the importance attached to the Cromarty Firth in relation to the Moray Firth as a whole.[23]

As already mentioned, the Cromarty Firth is composed of a number of definable sections or units each with its own particular characteristics of physical environment and flora and fauna. These units are dealt with below.

3.2.1.1. *Dingwall Bay.*

Dingwall Bay is an area of sand and mud flats more or less triangular in shape, lying adjacent to the Burgh of Dingwall.[31] The inner parts of the bay consist of mud while the outer part of the bay is pure sand. There are considerable areas of eelgrass (*Zostera* spp.) which mainly coincide with muddier areas, while glasswort (*S. europaea*) is widespread over most of the bay. One special feature is the presence of two colonies of cord-grass (*Spartina anglica*), a plant introduced with possible reclamation in mind.

Shoreward there is a long narrow strip of salt marsh, broken by reedbeds and opening out into a more extensive undisturbed marsh close to Dingwall. The flora present is typical of this habitat and includes those species listed in Table 5 as well as many other associated species. However, one species that is not as typical is couch-grass (*Agropyran repens*) which is found in the Dingwall Bay salt marshes forming drift line communities.[32]

The invertebrate fauna of the bay comprises both ARENICOLA and SCROBICULARIA communities. The SCROBICULARIA community is dominant in the muddy sediment of the inner part of the bay, especially where brackish conditions occur. At mid-shore level,

where the sediment becomes more sandy in nature ARENICOLA community species become dominant.[33] Species present within each community are listed in Table 5.

As to be expected in the Cromarty Firth, wintering waders and wildfowl are the most important feature of Dingwall Bay. The main species present are listed in Table 5. However, wading species are of less importance in terms of numbers present, due to most waders in the Firth being found at the Conon Islands which are upstream from this site.[23]

Table 5: Flora and Fauna Present within Dingwall Bay.[23, 32, 33]

Species	Scientific Name	Comments
Plants		
Red fescue	*Festuca rubra*	Typical salt marsh flora
Scurvy-grass	*Cochlearia officinalis*	
Marsh marigold	*Caltha palustris*	
Sea thrift	*Armeria maritima*	
Sea aster	*Aster tripolium*	
Sea milkwort	*Glaux maritima*	
Mud rush	*Juncus gerardii*	
Sea plantain	*Plantago maritima*	
Sea arrow-grass	*Triglochin maritima*	
Invertebrates		
Peppery furrow shell	*Scrobicularia plana*	These species form a SCROBICULARIA community
Ragworm	*Nereis diversicolor*	
Sand gaper	*Mya arenaria*	
Baltic tellin	*Macoma balthica*	ARENICOLA community species
Common cockle	*Cerastoderma edule*	
Lugworm	*Arenicola marina*	
Catworm spp.	*Nephtys hombergii*	
Birds		
Wigeon	*Anas penelope*	Number 400 to 600, but with a peak of 1,000
Teal	*Anas crecca*	Numbers are irregular but can reach 350
Mallard	*Anas platyrhyncha*	Number 50 and 150, but can peak at 500 plus
Red-breasted merganser	*Mergus serrator*	Number up to 50, though can peak at 400
Mute swans	*Cygnus olor*	Usually present between 20 and 70
Greylag goose	*Anser anser*	Numbers usually low, but can peak above 300
Goldeneye	*Bucephala clangula*	These species are all occasionally present
Goosander	*Mergus merganser*	
Shelduck	*Tadorna tadorna*	
Whooper swan	*Cygnus cygnus*	
Oystercatcher	*Haematopus ostralegus*	These two species are always present
Redshank	*Tringa totanus*	
Dunlin	*Calidris alpina*	These wader species occur in small numbers
Ringed plover	*Charadrius hiaticula*	
Curlew	*Numenius arquata*	
Lapwing	*Vanellus vanellus*	

3.2.1.2. *Conon Islands.*

These are a series of islands at the mouth of the River Conon, which flows past Dingwall into the upper reaches of the Cromarty Firth. Down stream of the islands there are shingle banks, however, as you move up stream there is a transition through salt marsh, brackish pools and wet pasture to scrub and finally to mature alder (*Alnus glutinosa*) woodland. This vegetation transition, related to decreasing salinity and other factors results in a very interesting group of habitats which are classed as a Site of Special Scientific Interest (SSSI) by Scottish Natural Heritage (SNH).

There is a rich flora associated with; a steep salinity gradient, flooding, soil type, water quality and shading. Mostly the flora is typical of similar situations elsewhere but there are additional species with northern distribution, such as bottle sedge (*Carex rostrata*), northern fen orchid (*Dactylorchis purpurella*) and blood-drop emlets (*Mimulus luteus*).[23]

Wildfowl and waders winter amongst the islands in good numbers, though under certain weather conditions wading birds can reach high peak numbers. However, Table 6 lists the regular levels of both waders and wildfowl present within the islands.

Conon Islands are one of the more important breeding habitats within the Cromarty Firth for many of the birds listed in Table 6, as well as common (*Larus canus*) and black-headed gulls (*Larus ridibundus*) and common terns (*Sterna hirundo*).

Table 6: Bird Species Present within the Conon Islands.[23]

Species	Scientific Name	Comment
Birds		
Wigeon	*A. penelope*	Numbers vary between 250 and 600
Teal	*A. crecca*	Numbers range up to 380
Mallard	*A. platyrhyncha*	Numbers range from 50 to 100
Greylag goose	*A. anser*	Up to 600 occur
Mute swan	*C. olor*	Up to 100 occur
Goldeneye	*B. clangula*	Smaller numbers of these species are present
Shelduck	*T. tadorna*	
Pintail	*Anus acuta*	
Red-breasted merganser	*M. serrator*	
Whooper swan	*C. cygnus*	Occasionally present
Oystercatcher	*H. ostralegus*	Usually around 35 present
Lapwing	*V. vanellus*	Up to 1,200 present

Table 6 continued

Redshank	*T. totanus*	Numbers range from 70 to 500
Curlew	*N. arquata*	Usually around 50 present
Dunlin	*C. alpina*	These wader species are less regularly seen
Ringed plover	*C. hiaticula*	
Common sandpiper	*Actitis hypoleucos*	
Greenshank	*Tringa nebularia*	
Bar-tailed godwit	*Limosa lapponica*	
Grey plover	*Pluvialis squatarola*	
Common snipe	*Gallinago gallinago*	

3.2.1.3. *Alness Bay.*

Alness Bay containing 530 hectares of intertidal flats, is one of the most important sectors of the Cromarty Firth, third in importance only to Nigg and Udale Bays. It supports considerable numbers of wintering wildfowl and waders on occasion, and has at its east and west ends two very interesting salt marshes, with lagoons at Balconie Point and a shingle spit at Teaninich, which add diversity to the habitat.

Sand is the substrate of most of the bay, however, there is some deep mud out towards the extensive edible mussel (*Mytilus edulis*) beds that are exposed only at low water. A ridge of sand and shingle in the middle of the bay supports an extensive growth of glasswort (*S. europaea*), while there is another main area related to a salt marsh below Wester Teaninich. Eelgrass (*Zostera* spp.) is most widespread at the east and west extremities of the bay, thinning out in mid-bay. There are also small areas of tassel pondweed (*R. maritima*) present. Alness Bay contains a rich algal flora numbering some 21 species and is possibly the most diverse site in the Cromarty Firth for algal flora.[23]

Salt marsh forms a narrow strip around much of the bay, but is best developed from below Wester Teaninich to Balconie. At Balconie, lagoons and saltings provide refuge and feeding grounds for wintering birds, especially at high tide and during rough weather, while eastward below Ballachraggan another extensive salt marsh stretches into a shingle spit where a number of bird species nest.

Both wildfowl and waders roost within the bay, with the most important roost being at the mouth of the Alness River, on salt marsh between the river and Dalmore Pier. Table 7 lists the most important bird species which utilise the bay.

Table 7: Bird Species Present within Alness Bay.[23]

Species	Scientific Name	Comment
Birds		
Wigeon	*A. penelope*	Number 500 to 600, but can peak at 3,000
Teal	*A. crecca*	Number 60 to 150, but can peak at 1,000
Mallard	*A. platyrhyncha*	Wintering numbers occur up to 400, there seldom being fewer than 100 present
Shelduck	*T. tadorna*	Numbers regularly reach 50 to 100
Mute swan	*C. olor*	Numbers vary up to 20
Whooper swan	*C. cygnus*	Occasionally come into feed from Dalmore Bay, flocks contain up to 70 birds on occasion
Greylag goose	*A. anser*	Occasionally occur in the bay
Red-breasted merganser	*M. serrator*	Occasionally seen
Oystercatcher	*H. ostralegus*	These are commonly seen on shingle spits
Redshank	*T. totanus*	
Ringed plover	*C. hiaticula*	
Common tern	*S. hirundo*	Up to 150 pairs nest in the bay
Arctic tern	*S. paradisaea*	Up to 150 pairs nest in the bay

A feature of special interest is the numbers of common seals (*Phoca vitulina*), which haul out on sand banks near the bay. The most frequently used sites are the sand banks below Shoretown.

3.2.1.4. *Nigg Bay.*

Of all the composite pieces that make up the Cromarty Firth, Nigg Bay is by far the most outstanding single part. As a result it is designated a National Nature Reserve (NNR) and is also the site of a Royal Society for the Protection of Birds (RSPB) Reserve. The bays intertidal area covers some 1,600 hectares, which represents one third of the total intertidal area present in the whole of the Cromarty Firth. Also, half of the Firths total available food resource for wildfowl and waders is to be found in Nigg Bay.[34]

The substrate of the bay is mainly sandy in nature, however, the mud content increases as you move out into the Firth. Sandstone bedrock breaks the surface on both the east and west sides of the bay, while on the northern shore a shingle beach is to be found. The intertidal area itself is dissected by four channels, the largest of which is the Pot Channel.

Over the whole intertidal area eelgrass (*Zostera* spp.) is to be found, in particular *Zostera angustifolia* and *Zostera noltii*. Some tassel pondweed (*R. maritima*) can be found towards

the upper reaches of the bay, and glasswort (*S. europaea*) is present in large amounts on both sides of the Balnagown River mouth and also in smaller quantities elsewhere, especially a narrow strip along the whole north shore of the bay.[23]

Salt marsh in the bay is limited in scale, areas occur at the mouth of the Balnagown River. Here pioneer communities are made up of cord-grass (*S. anglica*), the Cromarty Firth being the most northerly location for this species, also mid-marsh communities are made up of sea poa (*Puccinellia maritima*), which is only moderately abundant within Scotland.[32]

Within the intertidal area there is a good variety of invertebrates, although numbers of individual species are not particularly high compared with similar areas elsewhere in Britain. During surveys carried out in 1981, 53 individual species were recorded at Nigg Bay. Table 8 lists the main species present within the bay, which identify the faunistic community of the bay as ARENICOLA in nature.[34]

As a result of the large amount of suitable food material available, Nigg Bay is a collecting ground for large numbers of over wintering wildfowl and waders. Many of the wildfowl arrive from Iceland and northern Scandinavia and use Nigg Bay as a place to feed and rest before dispersing southwards to other parts of Britain.[30] Numbers of wildfowl peak in October and November, while numbers of waders peak during December and January. Recent counts for birds within the bay during these periods are listed in Table 8.

A breeding colony of common seals (*P. vitulina*) are to be found during the summer months hauled out within Nigg Bay.[35] Their pups are born during June and July with peak numbers in the Moray Firth in early July. This is followed by a moult in August, during which time the seals spend most of their time out of the water. They are opportunist predators feeding on a wide variety of prey and taking advantage of locally abundant prey species.[15] A total of 17 prey species have been identified in the Moray Firth, the most important of which are listed in Table 8.

Table 8: Fauna Present within Nigg Bay.[15, 23, 30, 34]

Species	Scientific Name	Comments
Invertebrates		
Laver spire shell	*Hydrobia ulvae*	This gastropod mollusc dominates upper intertidal areas, and is important in terms of biomass
Polychaete spp.	*Fabricia sabella*	All present in upper intertidal areas
	Pygospio elegans	
Oligochaete spp.	*Aktedrilus monosperme*	
	Tubificoides benedini	
Edible mussel	*M. edulis*	Present at mid-bay level, extensive beds spearate higher shore spp. from a low water zone of cleaner sand.
Paddle worm spp.	*Phyllodoce maculata*	All present in the cleaner sand zone
Catworm spp.	*N. hombergii*	
Sand worm	*Scoloplos armiger*	
Baltic tellin	*M. balthica*	All are present in the cleaner sand zone and are important in terms of biomass
Common cockle	*C. edule*	
Lugworm	*A. marina*	
Birds		
Wigeon	*A. penelope*	Average 500 to 1,000, but with peaks of 6,000
Teal	*A. crecca*	Usually number 20 to 40, but occasional peaks of 200
Mallard	*A. platyrhyncha*	Average 100 to 150, with peaks of 300
Shelduck	*T. tadorna*	Average between 15 and 30
Greylag goose	*A. anser*	Present in early winter
Pink-footed goose	*A. fabalis brachyrhynchus*	Present in late winter
Oystercatcher	*H. ostralegus*	Up to 1,000 usually present
Redshank	*T. totanus*	Up to 1,000 usually present
Dunlin	*C. alpina*	Up to 1,200 usually present
Knot	*Calidris canuta*	Up to 500 usually present
Bar-tailed godwit	*L. Lapponica*	Up to 500 usually present
Ringed plover	*C. hiaticula*	Up to 20 usually present
Curlew	*N. arquata*	Up to 350 usually present
Lapwing	*V. vanellus*	Up to 100 usually present
Mammals		
Common seal	*P. vitulina*	The most important prey items are; sandeel, sprat, herring, cod and atlantic salmon, although their diet can also include; whiting, flounder, plaice & curled octopus

3.2.1.5. *Udale Bay*

Udale Bay is in many ways complementary to Nigg Bay, forming the opposite side of the great flared embankment of the lower Cromarty Firth, and like Nigg Bay, is also designated as a National Nature Reserve (NNR) and the site of a Royal Society for the Protection of Birds (RSPB) Reserve. It is predominantly a sandy bay covering some 500 hectares, however some areas of mud are present, especially out in the Firth itself.

Within the intertidal area eelgrass (*Zostera* spp.) is abundant, while glasswort (*S. europaea*) is to be found in large amounts in the upper parts of the bay. One particular feature of Udale Bay is the now extensive spread of the introduced cord-grass (*S. anglica*).[23] As in Nigg Bay, salt marshes occur where a number of species are dominant. These species are listed in Table 9.

The invertebrate fauna of Udale Bay is rich in variety of species, but again like Nigg Bay, not in numbers of individual species. The main species, as well as those that are less abundant, are also listed in Table 9.

The tidal flats of the bay again provide sustenance for the large flocks of wildfowl and waders which winter there. Within Udale Bay typical December counts for shorebirds are again listed in Table 9.

Table 9: Flora and Fauna Present within Udale Bay.[30, 32, 33]

Species	Scientific Name	Comments
Plants		
Cord-grass	*S. anglica*	This is the main pioneer species of the salt marshes
Sea poa	*P. maritima*	These two species are dominant in salt marshes further up shore
Mud rush	*J. gerardii*	
Couch-grass	*A. repens*	Forms drift line communities in salt marshes
Invertebrates		
Baltic tellin	*M. balthica*	At low shore, this is the dominant species of an ARENICOLA community
King ragworm	*Nereis virens*	Higher up shore this species forms dense populations
Paddle worm spp.	*P. maculata*	Commonly seen on the surface in poorly drained areas
Edible mussel	*M. edulis*	Found over most of the bay, although abundance varies
Polychaete spp.	*C. practuenue*	None of these species occur in any abundance
	T. forberi	
	O. limacina	
	A. aulogaster	
Pearl bubble	*Retusa obtusa*	
Birds		
Shelduck	*T. tadorna*	Usually up to 25 present
Mute swan	*C. olar*	Usually up to 65 present
Wigeon	*A. penelope*	Up to 2,000 usually present
Teal	*A. crecca*	Usually up to 20 present
Mallard	*A. platyrhyncha*	Uually 150 present
Scaup	*Aythya marlia*	Usually 50 present
Goldeneye	*B. clangula*	Usually 30 present
Red-breasted merganser	*M. serrator*	Usually 50 present
Whooper swan	*C. cygnus*	Occasional or rare visitor

Table 9 continued

Oystercatcher	*H. ostralegus*	Up to 600 usually present
Redshank	*T. totanus*	Up to 300 usually present
Dunlin	*C. alpina*	Up to 200 usually present
Knot	*C. canuta*	Up to 100 usually present
Bar-tailed godwit	*L. Lapponica*	50 usually present
Ringed plover	*C. hiaticula*	20 usually present
Curlew	*N. arquata*	250 usually present
Lapwing	*V. vanellus*	10 usually present
Golden plover	*Pluvialis apricaria*	These waders are occasional or rare visitors
Black-tailed godwit	*Limosa limosa*	
Ruff	*Philomachus pugnax*	

At Udale Bay, like Nigg Bay across the Firth, breeding common seals (*P. vitulina*) are to be found during the summer. Pups are born on intertidal sand banks or in creeks within salt marshes.[35]

3.2.1.6. *North and South Sutors.*

The North and South Sutors make up the cliff lined mouth of the Cromarty Firth. While there are many seabird nesting cliffs in the north and west of Scotland there are few in the Moray Firth area. Therefore those of the North and South Sutors, and of nearby Castlecraig are of great importance to cliff dwelling seabirds within the Moray Firth. They are the only breeding sites for several hundred pairs of kittiwake (*R. tridactyla*), razorbill (*A. torda*) and guillemot (*U. aalge*), as well as colonies of cormorant (*Phalacrocorax carbo*) and shag (*Phalacrocorax aristotelis*) between the cliffs of Caithness and those at Troup Head in Banffshire. At Castlecraig in particular, many hundreds of herring gulls (*Larus argentatus*) and some greater black-backed gulls (*Larus marinus*) nest, while fulmars (*Fulmarus glacialis*) breed on the cliffs.[23]

The Moray Firth contains one of only two resident groups of bottlenose dolphins (*T. truncatus*), within the waters of the UK, and the only resident group in the North Sea. Surveys of the inner Moray Firth have shown that the area of coast from Tarbat Ness to the mouth of the Inverness Firth is an important area for the dolphins. This area includes the entrance to the Cromarty Firth between the north and south Sutors, which seems to be a particularly favourite spot of the dolphins.[35] In 1989, a survey was carried out to estimate

the size of the bottlenose dolphin (*T. truncatus*) population in the above area, the result was that at least 62 dolphins were resident within the area.[15]

3.2.2. The Dornoch Firth.

The Dornoch Firth is located between Loch Fleet to the north and the Cromarty Firth to the south. Unlike the Cromarty, Beauly and Inverness Firths, there has been hardly any development of the Dornoch Firth. This makes it the last truly unspoilt east coast Firth within Scotland, thus making it of special interest. As a result the whole of the Firth has been declared a National Scenic Area (NSA), however, only the outer part of the Firth achieves high scientific status, being categorised as a Site of Special Scientific Interest by Scottish Natural Heritage (SNH).

As stated above the area of main scientific and biological importance does not start until Edderton Bay, located on the southern shore of the Firth. Further east beyond this point, the outer parts of the Dornoch Firth are almost as important as sectors of the Cromarty Firth as far as wildfowl and wader populations are concerned. However, certain factors combine to make the Dornoch Firth the least important of the two. The two main factors causing this are, firstly, the smaller extent of organically and vegetationally rich mud flats in the Dornoch Firth, although both Firths have about the same area of intertidal flats. Secondly the fact that the Dornoch Firth is much more open to the sea and exposed to easterly winds.[23] This latter factor seems to be responsible for the Firth supporting far fewer wildfowl and waders than it is actually capable of.

As with the Cromarty Firth, the Dornoch Firth is comprised of a number of component units, each with different properties, that combine to form the entire Firth complex. Each of these sites can be dealt with individually.

3.2.2.1. *Edderton Sands.*

This is one of the most sheltered areas in the Dornoch Firth, being protected from easterly winds by the Meikle Ferry spit. As a result of this, large numbers of wildfowl can be found in this bay, though geese are not normally found unless bad weather forces them

down during migration. In contrast to wildfowl species, wader numbers are low within the bay. Table 10 lists those bird species present at Edderton Sands during winter months.

Table 10: Bird Species Present at Edderton Sands.

Species	Scientific Name	Comments
Birds		
Wigeon	*A. penelope*	Up to 2,000 present, with a possible maximum of 5,000
Teal	*A. crecca*	On average 300 usually present, although 800 can occur
Scaup	*A. marlia*	Regularly reach 200 but can peak at 450
Red-breasted merganser	*M. serrator*	These species occur in lesser numbers, with shelduck nesting in the area
Shelduck	*T. tadorna*	
Goosander	*M.. merganser*	
Pintail	*A. acuta*	
Mute swan	*C. olar*	Usually present in numbers of up to 40 at any one time
Oystercatcher	*H. ostralegus*	All occur regularly but in relatively low numbers
Redshank	*T. totanus*	
Dunlin	*C. alpina*	
Curlew	*N. arquata*	
Lapwing	*V. vanellus*	
Bar-tailed godwit	*L. Lapponica*	These two waders also occur, but in small numbers
Ringed plover	*C. hiaticula*	

During the summer breeding common seals (*P. vitulina*) are to be found hauled out on Edderton Sands. It has been estimated that 45% of the Moray Firth population of common seals (*P. vitulina*), conservatively estimated at 1,400, haul out within the Dornoch Firth due to the lack of disturbance compared to the other Firths.[35]

3.2.2.2. *Ardjachie Bay.*

This bay is to be found on the eastern side of the Meikle Ferry spit. Shorebirds move freely between Edderton Sands and Ardjachie Bay.

Again it is the wildfowl that tend to dominate the bay, those usually present are listed in Table 11. Of some interest is the occasional occurrence of eider duck (*Somateria mollissima*), there presence reflecting the increased influence of the open Firth here. Again the numbers of waders is not large but the commoner species do occur.

As with the presence of eider duck (*S. mollissima*), the increased influence of the open Firth is reflected by the presence of non-breeding groups of grey seals (*Halichoerus grypus*), which can be seen feeding offshore of the bay.[15]

Table 11: Bird Species Present within Ardjachie Bay.

Species	Scientific Name	Comments
Birds		
Wigeon	*A. penelope*	Up to 2,000 present, with a possible maximum of 3,000
Mallard	*A. platyrhyncha*	On average 200 can occur, with peaks of 600
Teal	*A. crecca*	On average 100 can occur, with peaks of 400
Shelduck	*T. tadorna*	100 individuals often occur
Pintail	*A. acuta*	Both species variable in number, but are usually present
Red-breasted merganser	*M. serrator*	
Mute swan	*C. olor*	This species occurs only infrequently
Oystercatcher	*H. ostralegus*	These common species regulaly occur but in relatively low numbers
Redshank	*T. totanus*	
Dunlin	*C. alpina*	
Curlew	*N. arquata*	
Knot	*C. canuta*	
Lapwing	*V. vanellus*	
Bar-tailed godwit	*L. Lapponica*	
Ringed plover	*C. hiaticula*	

3.2.2.3. *Skibo Estuary.*

The bars that form Cuthill Links on the north shore of the Dornoch Firth provide valuable shelter for the Skibo Estuary. The two narrow necks of the upper estuary have been artificially cut off from the main body of the Skibo Estuary. This has resulted in the formation of the fresh water lochs, Loch Evelix and Loch Ospidale.

The bird populations during winter of the three locations are inseparable due to their close proximity to one another, however, for all three areas it is thought that the factor of shelter is the most important element, as with Edderton Sands on the southern shore.

Again wildfowl are dominant, with this area being considered the best teal (*A. crecca*) site in the whole of the Moray Firth. As at Edderton Sands and Ardjachie Bay wading birds are few in number, but here, some less common species also occur. Table 12 over the page lists those bird species that can be found in the estuary, though in varying numbers.

Table 12: Bird Species Present at Skibo Estuary.[23]

Species	Scientific Name	Comments
Birds		
Teal	*A. crecca*	Skibo Estuary considered the best site in Moray Firth
Wigeon	*A. penelope*	On average 400 can occur, with peaks of 1,500
Mallard	*A. platyrhyncha*	Regularly exceed 100 and can peak at 200
Tufted duck	*Aythya fuligula*	Commonly reach 50, but can peak at 200
Shelduck	*T. tadorna*	These species commonly occur but in lower numbers. Some also breed in the area over the summer
Red-breasted merganser	*M. serrator*	
Pochard	*Aythya ferina*	
Goldeneye	*B. clangula*	
Scaup	*A. marlia*	
Gadwall	*Anas strepera*	
Mute swan	*C. olor*	
Whooper swan	*C. cygnus*	
Oystercatcher	*H. ostralegus*	These common species regulaly occur but in relatively low numbers
Redshank	*T. totanus*	
Curlew	*N. arquata*	
Lapwing	*V. vanellus*	
Grey plover	*P. squatarola*	These species occur less commonly
Common sandpiper	*A. hypoleucos*	
Greenshank	*T. nebularia*	

3.2.2.4. *Morrich More.*

This area is considered one of the most important dune systems in Europe, since it carries a wealth of species, many of them rare or local and as such it is of international importance.[31] It is also considered important because it clearly defines the transition from intertidal flats and salt marsh to sand dune and grassy pasture, and finally through to arable land. The site itself is situated on an out crop of land extending eastward along the southern shore of the Dornoch Firth. It lies between high dunes in the west near the town of Tain and Inver Bay to the east.

The tidal flats of the Morrich More system extend over 1,000 hectares, the majority of this area being plant bare. However, in Tain and Inver Bays, beds of green algae *Enteromorpha intestinalis* and *Enteromorpha compressa* and eelgrass (*Zostera* spp.) occur. Also in the Inver Bay area, small discontinuous areas of salt marsh have developed, forming a transition stage between sandy foreshore and dune slack.

The dune and slack system covers some 1,000 hectares, and as already mentioned is one of the most distinctive in Europe. The main area of the dune system is extremely rich in plant species, with surveys recording over 200 species of flowering plants. The flora present within both the salt marsh and dune system of the area are listed in Table 13.

Concerning invertebrate fauna, the middle and upper shore of Morrich More supports an ARENICOLA community, while towards low water spring tide level the species present form part of a TELLINA community. In contrast, at Inver Bay fewer species are to be found, however, those that are present are the most common species forming a TELLINA community.[33] Table 13 lists the species of invertebrates present at these sites.

Situated at Whiteness Sands there are sand flats, offshore bars and dune islands. These flats, in association with the nearby Loch Eye, form an important wintering ground for wildfowl, notable species are listed in Table 13. During the summer a great variety of breeding birds also occur, these species are also listed in Table 13.

Table 13: Flora and Fauna Present at Morrich More.[31, 32, 33]

Species	Scientific Name	Comments
Plants		
Glasswort	*S. europaea*	Both are dominant pioneer species within salt marsh areas
Sea poa	*P. maritima*	
Sea plantain	*P. maritima*	These species colonise the main marsh areas
Sea thrift	*A. maritima*	
Red fescue	*F. rubra*	
Narrow blysmus	*Blysmus rufus*	The most extensive populations of this species in Britain occur in upper marsh areas
Sea centaury	*Centaurium littorale*	A great variety of colour forms occur in upper marsh
Purple milk vetch	*Astragalus danicus*	These species are the more interesting of the 200 flowering species of plants found in the Morrich More dune slack system
Mountain everlasting	*Antennaria dioica*	
Curved sedge	*Carex maritima*	
Moonwort	*Botrychium lunaria*	
Dutch rush	*Equisetum hyemale*	
Lesser twayblade	*Listera cordata*	
Lesser butterfly orchid	*Platanthera bifolia*	
Scots gentian	*Gentianella amerella septentrionalis*	
Spring vetch	*Vicia lathyroides*	
Marram grass	*Ammophila arenaria*	Both species colonise outer dune islands
Lyme grass	*Elymus arenarius*	
Hairy heather	*Calluna vulgaris*	Both species occur in the older parts of the dune system
Crowberry	*Empetrum nigrum*	

Table 13 continued

Juniper	*Juniperus communis*	Areas of this species are grazed, a feature not known to occur in any other British dune system
Mosses & Lichens	-	Are an important element of the dune system habitat
Invertebrates		
Baltic tellin	*M. balthica*	Are dominant in the middle and upper shore of Morrich More, forming part of an ARENICOLA community
Laver spire shell	*H. ulvae*	
Lugworm	*A. marina*	
Sand worm	*S. armiger*	
Polychaete spp.	*C. praetenue*	These species are found towards low water spring tide level of the shore at Morrich More, forming part of a TELLINA community
	Retusa alba	
Catworm spp.	*N. hombergii*	
Bivalve mollusc spp.	*Thracia phyaseolina*	
Paddle worm	*P. maculata*	
Thin tellin	*Tellina tenuis*	Most common species at Inver Bay, forming a TELLINA community
Common cockle	*C. edule*	
Catworm spp.	*Nephtys caeca*	
Birds		
Wigeon	*A. penelope*	Whiteness Sands and Loch Eye form important wintering grounds for these species
Mallard	*A. platyrhyncha*	
Shelduck	*T. tadorna*	
Pint-footed goose	*A. fablis brachyrhynchus*	1,000 usually present in spring and autumn
Greylag goose	*A. anser*	800 to 1,600 usually present in spring and autumn, with a regular winter population of about 100
White-fronted goose	*Anser albifrons*	30 to 40 occur over winter, alternating between Morrich More and Loch Eye
Eider duck	*S. mollissima*	Limited numbers present
Mute swan	*C. olor*	Usually one pair always present
Oystercatcher	*H. ostralegus*	Nest over the whole are during the summer
Lapwing	*V. vanellus*	
Curlew	*N. arquata*	
Ringed plover	*C. hiaticula*	Nest on sandy areas only
Common gull	*L. canus*	200 pairs are estimated to be present
Greater black-backed gull	*L. marinus*	400 pairs are estimated to be present
Herring gull	*L. argentatus*	200 pairs are estimated to be present
Lesser black-backed gull	*Larus fuscus*	6 pairs are usually present
Common tern	*S. hirundo*	Both species nest in the area
Arctic tern	*S. paradisaea*	
Sandwich tern	*Sterna sandvicensis*	Large numbers nest during some years
Twite	*Carduelis flavirostris*	These small bird species are all represented
Linnet	*Carduelis cannabina*	
Skylark	*Alauda arvensis*	
Wren	*T. troglodytes*	
Wheatear	*Oenanthe oenanthe*	
Yellowhammer	*Emberiza citrinella*	
Corn bunting	*Miliaria calandra*	

Both common (*P. vitulina*) and grey seals (*H. grypus*) can be seen hauled out along this stretch of coastline. The most frequently used sites are Gallrope Bank, and the sand banks off Whiteness Sands.

3.2.3. Inverness Firth.

The Inverness Firth stretches from Fort George in the north-east, down to Longman Point and Inverness to the south-west, then back up to Chanonry Point in the north-east. Branching off the Firth to the west is Monlochy Bay and the Beauly Firth.

Characteristic plant species of the intertidal areas include glasswort (*S. europaea*), and the green algae species *E. intestinalis* and *E. compressa*. Strips of salt marsh with glasswort (*S. europaea*) and annual seablite (*Suaeda maritima*) pioneer communities are to be found at the west end of Longman Bay.[32]

Within the intertidal flats two invertebrate species, the sand worm spp. (*S. armiger*) and polychaete spp. *Peloscolex benedeni*, which both favour organically rich conditions, are more abundant here than in the Cromarty or Beauly Firths. Other common invertebrate species present within the Inverness Firth are listed in Table 14.

The flora and fauna, mentioned above and in Table 14, is rich in terms of available bird food resources, and the area undoubtedly provides an important winter refuge for shorebirds. Winter levels of wildfowl are also listed in Table 14, although recent counts have shown a reduction in bird numbers possibly due to illegal shooting, increased general disturbance and a deterioration in available food resources.

The Firth also supports good numbers of waders (see Table 14) as well as the commoner gulls which can be seen following fish shoals and feeding on the rubbish tip at Longman Point in Inverness.

Table 14: Fauna Present within the Inverness Firth.[33]

Species	Scientific Name	Comments
Invertebrates		
Baltic tellin	*M. balthica*	These species represent a well developed TELLINA community, which is rare in the Moray Firth
Lugworm	*A. marina*	
Catworm spp.	*N. hombergii*	
Polychaete spp.	*Ophelia cluthensis*	
Amphipod spp.	*Bathyporeia pilosa*	
Birds		
Wigeon	*A. penelope*	Between 1,350 and 3,000 can be present
Mallard	*A. platyrhyncha*	Between 115 and 400 can be present
Teal	*A. crecca*	Between 175 and 500 can be present
Pintail	*A. acuta*	Between 105 and 250 can be present
Goldeneye	*B. clangula*	Up to 240 can be present
Shelduck	*T. tadorna*	Up to 100 can be present
Mute swan	*C. olar*	Between 20 to 60 can be present
Oystercatcher	*H. ostralegus*	There are good numbers of both common and less common waders within the Inverness Firth
Redshank	*T. totanus*	
Dunlin	*C. alpina*	
Knot	*C. canuta*	
Curlew	*N. arquata*	
Lapwing	*V. vanellus*	
Black-tailed godwit	*L. limosa*	
Ruff	*P. pugnax*	
Greenshank	*T. nebularia*	
Whimbrel	*Numenius phaeopus*	
Grey plover	*P. squatarola*	
Grey phalarope	*Phalaropus fulicarius*	
Gannet	*Sula bassana*	Good numbers of these ocean birds can also be seen, especially off Longman Point
Great skua	*Stercorarius skua*	
Arctic skua	*Stercorarius parasiticus*	
Sandwich terns	*S. sandvicensis*	

At the entrance to the Firth, on the intertidal flats of Whiteness Head common seals (*P. vitulina*) haul out all year round, this site is also a well known breeding ground for the seals. However, numbers have been dropping over the years due to increased disturbance factors.[35] However, it is also known that since 1988 the population has fallen by 10 to 20% as a result of the 1988 Phocine Distemper Virus outbreak.

Two of the best sites within the Moray Firth for sighting the bottlenose dolphins (*T. truncatus*) from land are located within the Inverness Firth, these are Chanonry Point and North Kessock.

3.2.4. Monlochy Bay.

Monlochy Bay is a sheltered marine inlet on the south side of the Black Isle, with a fairly narrow opening into the Inverness Firth. Most of the inlet drains at low tide to expose 324 hectares of intertidal flats. There is one drainage channel which collects from five small fresh water inflows into the bay. The bay is classed as a Site of Special Scientific Interest (SSSI) by Scottish Natural Heritage (SNH), there being some botanical interest, but undoubtedly the main interest in the bay is ornithological. The bay is also designated as a Local Nature Reserve (LNR).

To the rear of the bay is a wide stretch of salt marsh containing typical plant species. These are listed in Table 15. The extensive mud and sand flats of the bay also have a good covering of vegetation that attracts over wintering shorebirds, the species present are also listed in Table 15.

The invertebrate fauna is relatively low in species number, but fairly dense populations of certain species occur in the channels and creeks of the salt marsh. These species, and others found lower down the bay in more muddier sediment are again listed in Table 15.

Counts of birds in the bay are good considering its size, though it is thought that numbers of wildfowl present have declined over the years due to increased disturbance factors and also due to the fact that the bay is shot over by wildfowlers three days a week. As to be expected, the commoner waders and gull species also utilise the bay in good numbers. Specific species present within the bay are listed in Table 15 over the page.

Table 15: Fauna Present within Monlochy Bay.[32, 33]

Species	Scientific Name	Comments
Plants		
Sea poa	*P. maritima*	A great deal of these two species can be found within the salt marsh present within the bay
Sea thrift	*A. maritima*	
Sand spurry	*Spergularia media*	These two speceis of sand spurry are found at higher levels within the salt marsh
	Spergularia marina	
Red fescue	*F. rubra*	Also found higher up the salt marsh present in the bay
Glasswort	*S. europaea*	Forms green mats on mud and sand in the southern part of the bay
Eelgrass	*Zostera spp.*	Grows over most of the bay
Green algae spp.	*E. intestinalis*	Both species are plentiful at the head of the bay
	E. compressa	
Invertebrates		
Sand gaper	*M. arenaria*	Dense populations are present in salt marsh creeks
Sand shrimp	*Corophium volutator*	
Ragworm	*N. diversicolor*	
Baltic tellin	*M. balthica*	These species are common lower down the bay where the sediment is muddier in nature
Common cockle	*C. edule*	
Lugworm	*A. marina*	
Catworm spp.	*N. hombergii*	
Edible mussel	*M. edulis*	Rich beds occur at extreme low water spring tide level
King ragworm	*N. virens*	
Sand gaper	*M. arenaria*	
Birds		
Wigeon	*A. penelope*	Usually between 400 and 800 occur
Mallard	*A. platyrhyncha*	Usually between 20 and 90 occur
Teal	*A. crecca*	Usually between 40 and 150 occur
Shelduck	*T. tadorna*	These over wintering duck species are also commonly present within the bay area
Goldeneye	*B. clangula*	
Red-breasted merganser	*M. serrator*	
Pochard	*A. ferina*	
Greylag goose	*A. anser*	
Pink-footed goose	*A. fabalis brachyrhynchus*	This species is only occasionally present
Oystercatcher	*H. ostralegus*	There are good numbers of both common and less common waders within the bay
Redshank	*T. totanus*	
Dunlin	*C. alpina*	
Knot	*C. canuta*	
Curlew	*N. arquata*	
Lapwing	*V. vanellus*	
Ringed plover	*C. hiaticula*	
Herring gull	*L. argentatus*	Can number anything from 200 to 800
Common gull	*L. canus*	Can be present in numbers between 100 and 410
Black-headed gull	*L. ridibundus*	These two species occasionally occur
Greater black-backed gull	*L. marinus*	
Fulmar	*F. glacialis*	Have occupied the cliffs at the mouth of the bay

3.2.5. The Beauly Firth.

The Beauly Firth is in many ways an extension of the Inverness Firth. It is located between Inverness itself and the town of Beauly to the west. The tidal flats of the Beauly Firth are some 1,000 hectares in extent, and are a fairly important wildfowl and wader wintering area. However, with one or two notable exceptions, fewer birds utilise the Firth than use both the Cromarty or Dornoch Firths. Therefore, only the western half of the Beauly Firth is categorised as a Site of Special Scientific Interest (SSSI) by Scottish Natural Heritage (SNH). This part of the Firth has also been proposed as a Local Nature Reserve (LNR).

Within the Firth itself there are very extensive areas of deep mud in the upper sections, especially towards the north shore, while towards the centre of the Firth the substrate becomes much more sandy in nature, forming huge sand banks. The plant species present are listed in Table 16. Salt marsh within the Firth varies from a narrow fringe in some parts to quite a wide stretch in others, again the most prominent species are also listed in Table 16.

As stated previously, the upper shore of the Firth is poorly sorted muddy sand, while the lower shore substratum is very soft mud. This results in the presence of invertebrate species that represent an ARENICOLA-SCROBICULARIA community.[33] The main species that form this community are listed in Table 16.

Wildfowl present in the Firth are also listed in Table 16 and include good numbers of goosander (*M. merganser*) and red-breasted merganser (*M. serrator*) which spend the winter in the Firth following shoals of fish. Peak numbers are associated with herring (*C. harengus*) and sprat (*S. sprattus*) shoals, in these peak years the Beauly Firth is the premier site in Britain for both red-breasted merganser (*M. serrator*) and goosander (*M. merganser*).

Wading birds do not frequent the Firth in great numbers, probably due to a lack of large numbers of invertebrate food species. However, the commoner species are joined by a number of rare wader species, all of which are included in Table 16.

Table 16: Flora and Fauna Present within the Beauly Firth.[32, 33]

Species	Scientific Name	Comments
Plants		
Sea club rush	*Scirpus maritimus*	Both are pioneer species in the deep mud of the upper sections of the Beauly Firth
Mud rush	*J. gerardii*	
Glasswort	*S. europaea*	Wildfowl food plants present within the Firth
Green algae spp.	*E. intestinalis*	
	E. compressa	
Tassel pondweed	*R. maritima*	
Eelgrass spp.	*Z. angustifolium*	Wildfowl food plant found in shallow flooded areas
	Z. noltii	Wildfowl food plant found in slightly drier areas
Reed	*Phragmites communis*	Large beds occur on the shore west of Lentran Point
Sea poa	*P. maritima*	Salt marshes are composed mainly of this species
Sea plantain	*P. maritima*	These species are also present in salt marshes but not to the same extent as sea poa
Sea aster	*A. tripolium*	
Sea arrow-grass	*Triglochin maritima*	
Narrow blysmus	*B. rufus*	
Invertebrates		
Baltic tellin	*M. balthica*	These species are present in the poorly sorted muddy sand of the upper shore of the Firth
Sand gaper	*M. arenaria*	
Ragworm	*N. diversicolor*	
Laver spire shell	*H. ulvae*	
Sand shrimp	*C. volutator*	Both species occur in the very soft mud of the lower shore, along with baltic tellin and sand gaper
Sand worm	*S. armiger*	
Birds		
Wigeon	*A. penelope*	These species reach only moderate numbers, but mallard also nest in the area
Mallard	*A. platyrhyncha*	
Teal	*A. crecca*	
Goldeneye	*B. clangula*	
Red-breasted merganser	*M. serrator*	Up to 200 is normal but can peak at over 600
Goosander	*M. merganser*	Regularly number 300, but can peak at 1,200
Greylag goose	*Anser anser*	Number 1,500 to 2,700 in Autumn, 500 in winter
Pint-footed goose	*A. fabalis brachyrhynchus*	Only small parties seen during the winter, but numbers build up to 500 between March and May
Canada goose	*Branta canadensis*	Are a special feature visiting between June and August
Red-breasted goose	*Branta ruficollis*	These geese are occasional visitors but all are rare
White-fronted goose	*A. albifrons*	
Barnacle goose	*Branta leucopsis*	
Shelduck	*T. tadorna*	30 are usually present during the summer
Mute swan	*C. olor*	A few pairs usually nest in the area
Oystercatcher	*H. ostralegus*	Average between 200 and 300
Lapwing	*V. vanellus*	Average between 200 and 450
Curlew	*N. arquata*	Average between 100 and 200
Knot	*C. canuta*	Numbers can reach up to 300 individuals
Dunlin	*C. alpina*	Average between 200 and 300
Bar-tailed godwit	*L. lapponica*	Can reach numbers up to 150
Grey plover	*P. squatarola*	

Table 16 continued

Purple sandpiper	*Calidris maritima*	These rare wader species all occur in the Firth
Whimbrel	*N. phaeopus*	
Spotted redshank	*Tringa erythropus*	
Green sandpiper	*T.ringa ochropus*	
Greenshank	*T. nebularia*	
Black-tailed godwit	*L. limosa*	

Seals regularly haul out on the sand banks, sand bars and mud flats which are connected to the shore at low tide, and up to 100 common seals (*P. vitulina*) have been recorded within the Firth.[35]

A school of harbour porpoises (*Phocaena phocaena*), may often be seen at the mouth of the Firth, close to Kessock Ferry. Harbour porpoises (*P. phocaena*) are probably the most abundant cetacean within the Moray Firth, being most easily observed during July and August.[28] The resident group of bottlenose dolphins (*T. truncatus*) are also commonly seen in the upper Beauly Firth, specifically between Alturlie Point and Bunchrew.[15]

3.3. *The Middle Firth.*

3.3.1. Loch Fleet.

Loch Fleet is located to the north of the Dornoch Firth, situated between the coastal towns of Dornoch and Golspie. Although smaller in size than the three main Firths of the inner Moray Firth, Loch Fleet still contains a wide expanse of sand flats covering 580 hectares in total.[30] Under the classification system of Scottish Natural Heritage (SNH), Loch Fleet is considered a Site of Special Scientific Interest (SSSI). The northern half is also a Scottish Wildlife Trust Reserve.

At the entrance to the estuary, waves have built a barrier practically across the mouth of Loch Fleet. A large number of shingle ridges, each 8 to 10 feet high compose this barrier which forms a recurved spit, stretching from Golspie to Littleferry.

Within the confines of the loch there are small areas of salt marsh. The main pioneer species and colonisers of older parts of the salt marshes are listed in Table 17.

To the west of the shingle ridges, fine muddy sands cover most of the shore area and are inhabited by an ARENICOLA community. To the east of the shingle ridges, the sediment

becomes coarser and cleaner, until at low water spring tide level a TELLINA community occurs. The invertebrate species that comprise these communities are listed in Table 17.

As a result of the available food resource listed in Table 17, Loch Fleet is a fine wildfowl and wader feeding and nesting area, to such an extent that the main interest of the tidal flats is the bird life that they sustain. This is made all the more important by the fact that Loch Fleet is considered far enough away from the complex of sites within the three Firths of the inner Moray Firth, to be regarded as a separate unit. Wintering numbers of wildfowl and waders are also listed in Table 17, as are those species of gull that are always present.

Table 17: Flora and Fauna Present within Loch Fleet.[23, 32, 31, 33]

Species	Scientific Name	Comments
Plants		
Sea poa	*P. maritima*	Main pioneer species, also occurs in mid-marsh areas
Scurvy-grass	*C. officinalis*	Colonisers of older parts of the salt marshes
Red fescue	*F. rubra*	
Fiorin	*Agrostis stolonifera*	
Mud rush	*J. gerardii*	Present in upper marsh areas
Couch-grass	*A. repens*	Forms drift line communities
Invertebrates		
Baltic tellin	*M. balthica*	Abundant species of an ARENICOLA community
Lugworm	*A. marina*	
Sand gaper	*M. arenaria*	
Thin tellin	*T. tenuis*	Sparse populations occur at low water spring tide level
Catworm spp.	*N. caeca*	
Sand worm	*S. armiger*	
Thin tellin	*T. tenuis*	Form a TELLINA community at low water spring tide level to the east of the Lochs shingle ridges
Tellin spp.	*Tellina fabula*	
Catworm spp.	*N. caeca*	
Brittle star spp.	*Acrocnida brachiata*	
Common cockle (juvenile)	*C. edule*	
Birds		
Wigeon	*A. penelope*	Number between 400 and 600, with a peak of 1,200
Mallard	*A. platyrhyncha*	Regularly reach 150, with a peak of 500
Teal	*A. crecca*	Can reach a peak of 240
Goldeneye	*B. clangula*	Regularly reach 40 individuals
Red-breasted merganser	*M. serrator*	Up to 150 have been recorded
Shelduck	*T. tadorna*	This species of duck breed in the general vicinity
Common scoter	*Melanitta nigra*	Up to 1,000 occur during periods of rough weather
Long-tailed duck	*Clangula hyemalis*	Also enter the estuary from offshore, but in smaller N^{o}
Oystercatcher	*H. ostralegus*	Number between 300 and 600, and can peak at 1,400
Redshank	*T. totanus*	Number between 50 and 100, and can peak at 250

Talbe 17 continued

Ringed plover	*C. hiaticula*	Range between 10 and 50, and can peak at 80
Curlew	*N. arquata*	Number between 50 and 100, and can peak at 250
Lapwing	*V. vanellus*	Present but seen with less regularity
Knot	*C. canuta*	
Dunlin	*C. alpina*	
Turnstone	*Arenaria interpres*	These wader species are only occasionally seen
Bar-tailed godwit	*L. lapponica*	
Grey plover	*P. squatarola*	
Golden plover	*P. apricaria*	
Whimbrel	*N. phaeopus*	
Common sandpiper	*A. hypoleucos*	
Sanderling	*Calidris alba*	
Ruff	*P. pugnax*	
Greater black-backed gull	*L. marinus*	Always present and breed in the estuary, some years in considerable numbers
Herring gull	*L. argentatus*	
Common gull	*L. canus*	
Black-headed gull	*L. ridibundus*	
Common tern	*S. hirundo*	
Arctic tern	*S. paradisaea*	
Sandwich terns	*S. sandvicensis*	
Great skua	*S. skua*	Occasionally sighted offshore
Arctic skua	*S. parasiticus*	
Glaucous gull	*Larus hyperboreus*	

Loch Fleet can be considered a spill over area of the Dornoch Firth as far as common seals (*P. vitulina*) are concerned. During those breeding seasons when haul out sites are at a premium in the Dornoch Firth, common seals (*P. vitulina*) can be seen at Loch Fleet, hauled out between early June and mid-September.[35]

3.3.2. Mound Alderwoods.

In 1816 an embankment called the Mound was built across the head of Loch Fleet sealing off an expanse of estuary. This became colonised by alder (*A. glutinosa*) and willow (*Salix* spp.) to form the present mixture of dense alder carr woodland and open fen. A few ridges which have probably always stood above the highest tides have an open growth of Scots pine (*Pinus sylvestris*). The alderwood itself is one of the largest in Britain and is of national importance. In 1963 it was declared a National Nature Reserve (NNR).

The area supports a large and varied flora associated with woodland, wetter swamp and salt marsh areas. The main species present are listed in Table 18.

A series of lagoons remains just inside the Mound, and these are a favourite wildfowl haunt. Overall more than 80 species of bird have been identified within the woods. Once again, the main species present are listed below in Table 18.

Table 18: Flora and Fauna Present within the Mound Alderwoods.[31]

Species	Scientific Name	Comments
Plants		
Tufted hair grass	*Deschompsia cespitosa*	These plant species feature in the drier alder areas
Soft rush	*Juncus effusus*	
Remote sedge	*Carex remota*	
Brown bent grass	*Agrostis canina*	
Yorkshire fog	*Holcus lanatus*	
Marsh ragwort	*Senecio aquaticus*	These species are common on wetter sites
Pennywort	*Hydrocotyle vulgaris*	
Marsh bedstraw	*Galium palustre*	
Meadowsweet	*Filipendula ulmaria*	
Willow	*Salix spp.*	Occurs among the alder woodland
Birch spp.	*Betula pendula*	These species are to be found among the Scots pine
	Betula pubescens	
Ash	*Fraxinus excelsior*	
Common sedge	*Carex nigra*	These two species dominate in the wetter swamp areas
Carnation grass	*Carex panicea*	
Marsh cinquefoil	*Potentilla palustris*	These characteristic wetland plants are also present in the wetter swamp areas
Devil's bit scabious	*Succisa pratensis*	
Red rattle	*Pedicularis palustris*	
Cotton grass	*Eriophorum angustifolium*	
Jointed rush	*Juncus articulatus*	
Common spike rush	*Eleocharis palustris*	
Few-flowered spike rush	*Eleocharis quinquetlora*	
Mud rush	*J. gerardii*	These salt marsh species occur where saline influence is still strong
Sea rush	*Juncus maritimus*	
Sea milkwort	*G. maritima*	
Sea plantain	*P. maritima*	
Sea club rush	*S. maritimus*	
Common spike rush	*E. palustris*	
Birds		
Mallard	*A. platyrhyncha*	Breed in the area, and up to 100 are present in winter
Wigeon	*A. penelope*	Also breed, and up to 70 occur over the winter
Pintail	*A. acuta*	These species breed regularly in the area
Tufted duck	*A. fuligula*	
Goldeneye	*B. clangula*	
Shelduck	*T. tadorna*	
Mute swan	*C. olor*	
Whooper swan	*C. cygnus*	
Buzzard	*Buteo buteo*	These birds of prey ocur regularly in the woodland
Kestrel	*Falco ostralegus*	

Table 18 continued

Oystercatcher	*H. ostralegus*	These common wader species nest in the area
Lapwing	*V. vanellus*	
Curlew	*N. arquata*	
Redshank	*T. totanus*	
Knot	*C. canuta*	These two wader species only vist the area
Greenshank	*T. nebularia*	
Gull spp.	*Larus spp.*	Many gulls frequent the swamp areas
Fulmar	*F. glacialis*	Nest on the cliffs at Creag Amalaidh

3.3.3. Findhorn Bay.

Findhorn Bay is the furthest east of the estuaries of the Moray Firth, being situated between Nairn to the west and Burghead to the east, on the southern shore of the Moray Firth. It is a complex river estuary whose origin and structure is closely related to the adjoining Culbin Sands area. It is classified as a Site of Special Scientific Interest (SSSI) by Scottish Natural Heritage (SNH), and has been proposed as a Local Nature Reserve (LNR) by Moray District Council.

Salt marsh is present in the bay, glasswort (*S. europaea*) is abundant in this, and in other areas eelgrass (*Zostera* spp.) is to be found but not in abundant quantities. The main plant communities to be found in the salt marsh areas are listed in Table 19.

Above mid-shore, the substratum of the bay is muddy sand which contains a high proportion of silt. Species present are those of an ARENICOLA-SCROBICULARIA community. Mid-shore sediments have medium sand particles intermixed with fine muddy sand and silt, here the infauna again approaches that of a SCROBICULARIA community. Further down shore the sediment becomes coarser and more scoured, as a result the dominant species change once more. The invertebrate species present within these communities are listed in Table 19.

Like the majority of sheltered areas in the Moray Firth, Findhorn Bay is an important wintering area for wildfowl and waders as well as gull species. However, when assessing the importance of the bay to bird life, it must be realised that there is constant movement between Findhorn Bay and the coast off Culbin Sands. Due to this fact, when general numbers for birds present are cited for this area, the whole stretch of coast from Burghead

to Nairn Bar is regarded as a single unit. However, the figures presented in Table 19 are for the inner estuary of Findhorn Bay alone.

A range of factors combine to make Findhorn Bay a good site for birds, these include shelter, food resource and a locality close to migration routes. All these factors combine to make Findhorn Bay a most valuable site for birds.

Table 19: Flora and Fauna Present within Findhorn Bay.[15, 23, 32, 33]

Species	Scientific Name	Comments
Plants		
Sea poa	*P. maritima*	These are the main plant species found in salt marsh areas within the bay
Red fescue	*F. rubra*	
Mud rush	*J. gerardii*	
Couch-grass	*A. repens*	
Great reedmace	*Typha latifolia*	Occur at the upper end of the bay, being predominantly fresh water species
Bog rush spp.	*Schoenoplectus tabernaemontani*	
Invertebrates		
Baltic tellin	*M. balthica*	Most abundant species of an ARENICOLA-SCROBICULARIA community above mid-shore level
Lugworm	*A. marina*	
Ragworm	*N. diversicolor*	
Sand shrimp	*C. volutator*	
Sand gaper	*M. arenaria*	Dominant species at mid-shore level
Thin tellin	*T. tenuis*	Dominant species at the lower shore levels
Catworm spp.	*N. cirrosa*	
Birds		
Wigeon	*A. penelope*	Regularly number 300 to 500, but can peak at 5,000
Mallard	*A. platyrhyncha*	Regularly reach 50, with a peak of 380
Shelduck	*T. tadorna*	20 are usually present
Teal	*A. crecca*	Small groups of these species may also be seen
Red-breasted merganser	*M. serrator*	
Scaup	*A. marlia*	
Greylag goose	*A. anser*	Number between 200 and 400, but can peak at 750
Pink-footed goose	*A. fabalis brachyrhynchus*	Pass over head but few land
Brent goose	*Branta bernicla*	Once present in large numbers, now returning to the bay
Mute swan	*C. olor*	Up to 17 can be present
Whooper swan	*C. cygnus*	Up to 14 can be present
Eider duck	*S. mollissima*	During storms these sea duck species come into the bay seeking shelter, often in large numbers
Common scoter	*M. nigra*	
Velvet scoter	*O. fusca*	
Long-tailed duck	*C. hyemalis*	
Oystercatcher	*H. ostralegus*	Usually number 1,000, though much higher peaks occur
Redshank	*T. totanus*	Usually number 1,000, though much higher peaks occur
Curlew	*N. arquata*	Usually number 200, though much higher peaks occur
Lapwing	*V. vanellus*	Usually number 300, though much higher peaks occur

Table 19 continued

Dunlin	*C. alpina*	Usually number 400 though much higher peaks occur
Knot	*C. canuta*	Smaller numbers of these wader species occur
Ringed plover	*C. hiaticula*	
Golden plover	*P. apricaria*	
Bar-tailed godwit	*L. lapponica*	
Greenshank	*T. nebularia*	
Sanderling	*C. alba*	
Little stint	*Calidris spp.*	These wader species are only occasionally seen
Common sandpiper	*A. hypoleucos*	
Spotted redshank	*T. erythropus*	
Ruff	*P. pugnax*	
Black-tailed godwit	*L. limosa*	
Green sandpiper	*T. ochropus*	
Whimbrel	*N. phaeopus*	
Greater black-backed gull	*L. marinus*	During any one winter up to 500 can be present
Herring gull	*L. argentatus*	During any one winter up to 300 can be present
Black-headed gull	*L. ridibundus*	During any one winter up to 500 can be present

Small groups of common seals (*P. vitulina*) can often be seen hauled out at the entrance to Findhorn bay, where sand flats are exposed at low tide. Findhorn Bay is also one of the few places left in eastern Scotland where otters (*Lutra lutra*), can be seen in there natural environment.[35]

3.3.4. Culbin Sands.

Culbin Sands is a large area of exceptional scientific interest, and as such is designated a Site of Special Scientific Interest (SSSI) by Scottish Natural Heritage (SNH). It is located between Findhorn Bay to the east and stretches to Nairn Bar in the west. A great part of this area has been afforested, but there are still many hectares of unspoilt sand flats and dunes, salt marshes, shingle features and freshwater lochs. However, the main interest of the sites lies in its plant communities and bird life, in fact the Nairn Bar which is a storm ridge composed of sand and pebbles is a Royal Society for the Protection of Birds (RSPB) Reserve. On this bar, marram grass (*A. arenaria*), sand sedge (*Carex arenaria*) and other common shingle and dune species occur.

Culbin Sands has an exceptionally rich and diverse flora, made up of some 450 species of both flowering plants and ferns which include some introduced and critical species. One of the main reasons Culbin Sands is so important for flora is because it is situated at a plant

geographical boundary zone with some 48 species of flowering plants at their northern limit and 3 species at their southern limit for the east coast of Britain. Near by Loch Loy and Loch Cran have their own distinctive flora, which includes a variety of pondweed species which are listed in Table 20.

The eastern section of Culbin Sands has a clean sediment of fine sand which supports a restricted CRUSTACEAN-POLYCHAETE community. In contrast the sediment below mean tide level is mostly occupied by an ARENICOLA community. Towards the western end, firm fine sand supports a rich surface coverage of eelgrass (*Zostera* spp.) and a number of invertebrate species which are listed in Table 20.

The coastal strip of the Culbin Sands provides a feeding and roosting area for many species of wildfowl, waders and other birds. The species present are also listed in Table 20.

Table 20: Flora and Fauna Present at Culbin Sands.[31, 33]

Species	Scientific Name	Comments
Plants		
Bog pondweed	*Potamogeton polygonifolius*	These pond weed species form part of the distinctive flora at Loch Loy and Loch Cran
Various-leaved pondweed	*Potamogeton gramineus*	
Grassy pondweed	*Potamogeton obtusifolius*	
Small pondweed	*Potamogeton berchtoldii*	
Slender-leaved pondweed	*Potamogeton filiformis*	
Invertebrates		
Baltic tellin	*M. balthica*	Most abundant species of an ARENICOLA community occurring below mean tide level
Lugworm	*A. marina*	
Common cockle	*C. edule*	
Laver spire shell	*H. ulvae*	Species found towards the western end of Culbin Sands
Sand shrimp	*C. volutator*	
Common cockle (juvenile)	*C. edule*	
Amphipod spp.	*B. pilosa*	Dominant crustacean at low shore level
Birds		
Mallard	*A. platyrhyncha*	Regularly reach 500 during winter months
Wigeon	*A. penelope*	Regularly number 300 during winter months
Red-breasted merganser	*M. serrator*	Regularly number 300 during winter months
Shelduck	*T. tadorna*	These two species also occur in good numbers
Teal	*A. crecca*	

Table 20 continued

Common scoter	*M. nigra*	Up to 500 can occur offshore
Velvet scoter	*O. fusca*	Up to 300 can occur offshore
Long-tailed duck	*C. hyemalis*	Good numbers of this duck species also occur offshore
Greylag goose	*A. anser*	Visit occasionally but in small numbers
Mallard	*A. platyrhyncha*	These bird species occur regularly at Loch Loy and Loch Cran during winter months
Wigeon	*A. penelope*	
Teal	*A. crecca*	
Pintail	*A. acuta*	
Pochard	*A. ferina*	
Tufted duck	*A. fuligula*	
Scaup	*A. marlia*	
Goldeneye	*B. clangula*	
Red-breasted merganser	*M. serrator*	
Mute swan	*C. olor*	
Whooper swan	*C. cygnus*	
Greylag goose	*A. anser*	
Oystercatcher	*H. ostralegus*	Several thousand visit each year
Redshank	*T. totanus*	These species also occur in good numbers at Culbin Sands, but not to the same extent as oystercatchers
Curlew	*N. arquata*	
Dunlin	*C. alpina*	
Ringed plover	*C. hiaticula*	
Bar-tailed godwit	*L. lapponica*	
Sanderling	*C. alba*	
Turnstone	*A. interpres*	
Grey plover	*P. squatarola*	
Common tern	*S. hirundo*	
Arctic tern	*S. paradisaea*	
Capercailzie	*Tetrao urogallus*	These bird species nest within the alder, willow and birch tree areas of Culbin Sands
Blue tit	*Parus caeruleus*	
Coal tit	*Parus ater*	
Great tit	*Parus major*	
Scottish crossbill	*Loxia scotica*	
Buzzard	*B. Buteo*	

3.4. *The Outer Moray Firth.*

3.4.1. Helmsdale to Duncansby Head.

The dominant coastal feature of the northern shore of the outer Moray Firth are cliffs, for example those of east Caithness, therefore, most of this coastline is classed as very exposed. Apart from a small bay head beach at Freswick, the only substantial stretch of soft coastline is Sinclair's Bay. The remainder of the coastline is a mixture of limited rocky shore and sheer cliffs.[14] Below are listed specific locations of interest.

3.4.1.1. *Helmsdale to Helman Head.*

This stretch of coastline represents 40km of stratified sandstone cliffs which include the most important breeding seabird colonies on mainland Scotland. Specific sites include; Stack O' Brough, Iresgoe, Ulbster, Bruan, Halberry Head, An Dun, Inver Hill and Badbea. Of these, the Inver Hill colonies are the most important, and largest in mainland Scotland. The numbers of breeding pairs that can be present at these sites are listed in Table 21.

Table 21: Bird Species Present on Cliffs Between Helmsdale and Helman Head.[35]

Species	Scientific Name	Comments
Birds		
Fulmar	*F. glacialis*	22,456 pairs have been recorded
Arctic skua	*S. parasiticus*	Up to 42 pairs are usually present
Kittiwake	*R. tridactyla*	49,529 pairs have been recorded
Guillemot	*U. aalge*	75,777 pairs have been recorded
Razorbill	*A. torda*	15,269 pairs have been recorded
Atlantic puffin	*Fratercula arctica*	Up to 270 pairs regularly occur
Cormorant	*P. carbo*	Up to 613 pairs regularly occur
Shag	*P. aristotelis*	2,567 pairs have been recorded
Common gull	*L. canus*	Up to 636 pairs are usually present
Lesser black-backed gull	*L. fuscus*	Up to 351 pairs regularly occur
Herring gull	*L. argentatus*	27,879 pairs have been recorded
Greater black-backed gull	*L. marinus*	1,396 pairs have been recorded
Common tern	*S. hirundo*	Up to 937 pairs regularly occur
Arctic tern	*S. paradisaea*	Up to 742 pairs regularly occur
Little tern	*S. albifrons*	Up to 31 pairs are usually present
Black guillemot	*Cepphus grylle*	1,737 pairs have been recorded

At the foot of these cliffs grey seal (*H. grypus*) breeding sites have been observed on rocky cobble beaches and in the many caves present.

3.4.1.2. *North Head to Noss Head.*

This short section of coast forms a headland between Wick Bay to the south and Sinclair's Bay to the north. Here the intertidal area is of a rocky nature, numerous boulders and stones litter the upper and middle shore and there are many shallow pools. Various green algae species and common limpets (*Patella vulgata*) form the dominant community over about half the shore, with a brown algae (*Laminaria* spp.) zone below. Shaded overhangs near low water spring tide level support locally good growths of the red algae spp. (*Plumaria elegans*), the purse sponge spp. (*Grantia compressa*) and the breadcrumb

sponge (*Halichondria panicea*). A fair range of red algae species are present, including epiphytes on cuvie kelp (*Laminaria hyperborea*), such as *Callophyllis laciniata* and *Ptilota plumosa*. Of the turnable boulders present, the undersurfaces are characteristically dominated by spirorbid worms (*Spirorbis* spp.) and the barnacle species (*Verruca stroemia*), together with encrusting Bryozoa, occasional crustaceans, nudibranchs, molluscs and echinoderms.[33,36]

3.4.1.3. *Sinclair's Bay.*

Sinclair's Bay is the only substantial stretch of soft coastline along the northern flank of the outer Moray Firth. With a length of 5km Sinclair's Bay is one of the largest beach and dune units in northern mainland Scotland. The shore itself is low in silt and clay content, and is fairly mobile as a result of being subjected to moderately exposed wave action. As a result, the intertidal area is plant bare, but there is a diverse infauna comprising a CRUSTACEAN-POLYCHAETE community. Species that comprise this community are listed in Table 22 below.

Table 22: Fauna Present at Sinclair's Bay.

Species	Scientific Name	Comments
Invertebrates		
Lugworm	*A. marina*	This diverse infauna represents a CRUSTACEAN-POLYCHAETE community
Borrowing worm	*Capitella capitata*	
Polychaete spp.	*Spiophanes bombyx*	
	Spio filicornis	
	Malacoceros fuliginosa	
Amphipod spp.	*Haustorius arenarius*	
	B. pilosa	

3.4.1.4. *Duncansby Head.*

The cliffs at Duncansby Head support large sea bird colonies. Guillemot (*U. aalge*), kittiwake (*R. tridactyla*), fulmar (*F. glacialis*), razorbill (*A. torda*), shag (*P. aristotelis*), gulls (*Larus* spp.) and atlantic puffins (*F. arctica*) can all be seen regularly in this area during the summer breeding season.[37]

3.4.2. Lossiemouth to Rattray Head.

The southern coast of the outer Moray Firth from Lossiemouth eastward is predominantly rocky in character, with a series of bays and coves separating headlands. These headlands often have a coastline made up of steep cliffs, for example, at Troup Head, Lions Head and Pennan Head. As with the Caithness coast, there are no estuaries of significant size.[14] Below are listed specific locations of interest.

3.4.2.1. *Spey Bay.*

This is the largest bay on the southern shore of the Moray Firth being some 7km long. There is a bay head beach and a small estuary where the River Spey enters the Firth. Surveys have indicated that this bay is a important feeding area for the resident group of bottlenose dolphins (*T. truncatus*), which can be regularly seen in the bay. The 5 species of sea duck common to the Firth during winter are all found offshore of Spey Bay.[38]

3.4.2.2. *Gardenstown.*

Gardenstown lies in the shelter of Gamarie Bay, one of the longer bays along this coastline. The shores are rocky with the exception of one small area of sediment in the south-west corner of the bay. Various green algae species, common limpets (*P. vulgata*), and acorn barnacles (*Balanus balanoides*) provide variable cover over half of the shore, and there is an extensive, 50m wide, brown algae (*Laminaria* spp.) forest lower down the shore. In 1979 Wilkinson recorded 121 species of brown, red and green seaweed at Gardenstown.

To the west of the towns harbour, the upper two thirds of the shore are littered with small boulders and stones which are too mobile to harbour a cryptofauna. On the lower shore however, there are good turnable boulders whose associated fauna is quite rich. Prominent species present are listed in Table 23. To the east of the harbour there are many undercut sandstone outcrops which prove a good habitat for a number of algal and invertebrate species, these are also listed in Table 23.

Table 23: Flora and Fauna Present at Gardenstown.[33]

Species	Scientific Name	Comments
Plants		
Cuvie kelp	*L..hyperborea*	These two brown algae species are prominant to the west of the towns harbour
Sugar kelp	*Laminaria saccharina*	
Red algae spp.	*P. elegans*	These red algea species are well developed to the east of the towns harbour
	Plumaria plumosa	
	Membranoptera alata	
	Odonthalia dentata	
	Gigartina stellata	
	Ceramium rubrum	
Invertebrates		
Brown-clawed porcelain crab	*Porcellana platycheles*	These species are also prominant west of the harbour
Common brittle star	*Ophiothrix fragilis*	
Common starfish	*Asterias rubens*	
Barnacle spp.	*V. stroemia*	
Scarlet starfish	*Henricia oculata*	These species occur less frequently west of the harbour, along with various sponges and nudibranchs. The presence of the boring mollusc, oval piddock within the soft sandstone of the bay is of special interest
Polychaete spp.	*Polyclinum aurantium*	
	Pholis gunnellus	
Oval piddock	*Zirfaea crispata*	
Breadcrumb sponge	*H. panicea*	Excellent growths occur on undercut sandstone outcrops east of the towns harbour
Purse sponge spp.	*G. compressa*	
Hydroid sea fir spp.	*Dynamena plumaria*	

3.4.2.3. *Troup Head.*

The cliffs here are the location of the main breeding sites for seabirds on the southern shore of the Moray Firth. Information on the numbers of birds is limited, however, the species present include; fulmar (*F. glacialis*), arctic skuas (*S. parasiticus*), kittiwake (*R. tridactyla*), guillemot (*U. aalge*), razorbill (*A. torda*), atlantic puffin (*F. arctica*) and gannet (*S. bassana*).[39]

3.4.2.4. *Pennan Bay.*

The coastline from Lion's Head to Pennan Head includes Cullykhan and Pennan Bays. The former contains a small pocket beach, while the latter is mainly rocky in nature. Specifically within Pennan Bay, the shore is rather flat, and consists of irregular sandstone with large boulders below a cliff to the east of the towns harbour. The upper shore here has fine growths of the green algae (*Prasiola stipitata*) and blue-green algae, together with abundant rough periwinkles (*Littorina saxatilis*). Shallow channels run down the shore,

and these support abundant areas of the green algae (*Cladophora rupestris*). Lower down the shore at the low water mark a shallow lagoon has formed, this contains many algal species which are listed in Table 24, as is the fauna present beneath boulders on the shore.

To the west of the harbour the shore is again backed by cliffs and is composed of irregular rocks, with boulders becoming more frequent towards low water. In contrast to the eastern side of the bay, the shore here is subject to considerable sand influence, which has had an effect on the species present, which are also listed in Table 24.

Table 24: Flora and Fauna Present within Pennan Bay.[33]

Species	Scientific Name	Comments
Plants		
Sea oak	*Halidrys siliquosa*	These algae species occur at the low water mark in a shallow lagoon
Sugar kelp	*L. saccharina*	
Red algae spp.	*Dilsea carnosa*	
	Laurencia pinnatifida	
	Furcellaria lumbricalis	
Red algae spp.	*Cladostephus spongiosus*	These two species are associated with sand to the west of the harbour
	F. lumbricalis	
	P. elegans	These two species are abundant in pools between boulders to the west of the harbour
	G. stellata	
Sand-binding algae	*Audouinella floridula*	Abundant growths cover boulders west of the harbour
Invertebrates		
Edible crab	*Cancer pagurus*	These species occur beneath boulders In general the fauna on the west side of the harbour is fairly poor due to the influence of the sand
Common brittle star	*O. fragilis*	
Spirorbid worm	*Spirorbis spp.*	
Barnacle spp.	*V. stroemia*	
Polychaete spp.	*Leuconia barbata*	
Common limpet	*P. vulgata*	This species is the dominant biota along with red algea

3.5. *The Pelagic Environment.*

However, the main asset of the outer Moray Firth is not its shoreline habitats but its sublittoral environment, after all the majority of this is situated within the area of the outer Moray Firth, and includes the Smith Bank, which is a most valuable area as far as fisheries are concerned. Therefore the pelagic environment of the Moray Firth is discussed under the outer Firth category. This is not to say that the plankton, fish, crustacean and mollusc species discussed do not occur in the other parts of the Firth, but mearly that they generally occur most frequently and abundantly in the outer part of the Moray Firth.

3.5.1. Plankton.

The phytoplankton and zooplankton populations are typical for the area concerned. The distribution and abundance of phytoplankton varies seasonally in different areas of the Moray Firth, but overall the situation is typical of coastal regions. During the spring there is a bloom of phytoplankton which results in an increase in zooplankton numbers, in autumn there is another slightly smaller bloom with the same results until late autumn and winter when increased water mixing occurs and phytoplankton levels are reduced throughout the Moray Firth.[15]

3.5.2. Pelagic Fish.

Pelagic fish species found in the Moray Firth are listed in Table 25 below.

Table 25: Pelagic Fish Species of Importance within the Moray Firth.[35]

Species	Scientific Name	Comments
Fish		
Mackerel	*Scomber scombrus*	Under take summer feeding during July and September. There feeding area extends into the Moray Firth.
Herring	*Clupea harengus*	Also feed within the Moray Firth, it is also an important nursery ground. In two localities, off the east Caithness cliffs and off the far eastern point of the southern Moray Firth coastline, herring also spawn. This takes place between late autumn and early winter, exact timing depending on locality.
Sprat	*Sprattus sprattus*	Are relatively shallow water pelagic fish which spawn offshore in the North Sea and then migrate inshore to over winter. Small concentrations are found within the inner Moray Firth area.
Atlantic salmon	*Salmo salar*	Salmon are anadromous, which means that they are born in fresh water, but live the majority of their lives in the sea. They then re-enter the river of their birth in order to spawn. This spawning takes place between October and January. In the Moray Firth area, prominent salmon rivers include the rivers; Wick, Shin, Bran, Conon, Ness and Spey.

3.5.3. Demersal Fish.

Demersal species found in the Moray Firth are listed over the page in Table 26.

3.5.4. Shellfish.

Shellfish species are abundant in the Moray Firth, important species are listed in Table 27.

3.5.5. Marine Mammals.

As previously mentioned, the inner Moray Firth supports a number of marine mammals, however, it is the waters of the outer Firth that are visited on occasion by a variety of less common cetacean species. These cetacean species are listed in Table 28 over the page.

Table 26: Demersal Fish Species of Importance within the Moray Firth.[9,35]

Species	Scientific Name	Comments
Cod	*Gadus morhua*	Cod spawn within the outer waters of the Moray Firth, this occurs between February and April. The juvenile cod remain inshore throughout the year but, after spawning, adults move to deeper water to feed out in the North Sea during the summer. Immature cod leave the Firth as two year old fish.
Haddock	*Melanogrammus aeglefinus*	Haddock are present in the Moray Firth in large numbers in summer and autumn. Adults migrate into deeper waters in January and February, spawning there in March and April. Juvenile haddock move into the shallow waters of the Firth and remain there throughout the year.
Whiting	*Merlangius merlangus*	Whiting spawn between January and July within the Moray Firth. Adults are very common in inshore waters and at depths between 30 and 100m.
Saithe	*Pollachius virens*	Saithe have their nursery grounds all along the coast of the Moray Firth. Of special importance is the Smith Bank area.
Plaice	*Pleuronectes platessa*	Plaice have spawning areas in the Moray Firth, in fact it is the most important spawning ground for plaice in the northern North Sea. The most important sites are offshore of the Caithness cliffs and around the Smith Bank area. Spawning takes place in January or early February. The southern coast provides good nursery areas for young plaice.
Lemon Sole	*Microstomus kitt*	Lemon Sole use the outer Moray Firth as one of their main spawning areas in the northern North Sea. This takes place from May to September.

Table 27: Shellfish Species of Importance within the Moray Firth.[9,35]

Species	Scientific Name	Comments
Norway lobster	*Nephrops norvegicus*	Found within the southern half of the outer and middle Firth area, preferring mud and sandy mud bottoms in which to construct their burrows. It is thought that the Moray Firth stock is self contained by residual currents affecting larvae dispersal. Spawning takes place from August through to November, with hatching from late April to August.
Edible crab	*C. pagurus*	Edible crab have a discontinuous distribution on the east coast of Scotland, including the Moray Firth.
Lobster	*Homarus gammarus*	Lobsters are found in the coastal fringe, especially between Peterhead and MacDuff, and the north-west corner of the outer Moray Firth.
Squid spp.	*Loligo forbesi*	These two squid species can occur in the outer Firth in late summer and autumn.
	Alloteuthis subulata	

Table 28: Cetacean Species that can be Present within the Outer Moray Firth.[35]

Species	Scientific Name	Comments
Minke whale	*Balaenoptera acutorostrata*	All these cetacean species have been infrequent visitors to the Moray Firth
Common dolphin	*Delphinus delphis*	
Killer whale	*Orcinus orca*	
White-beaked dolphin	*Lagenorhynchus albirostris*	
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	
Long-fined pilot whale	*Globicephala melaena*	
Risso's dolphin	*Grampus griseus*	
Northern bottlenose whale	*Hyperoodon ampullatus*	
False killer whale	*Psuedorea crassidens*	
Humpback whale	*Megaptera novaeangliae*	

3.6. *Map 6: Key Coastal Ecosystems.*

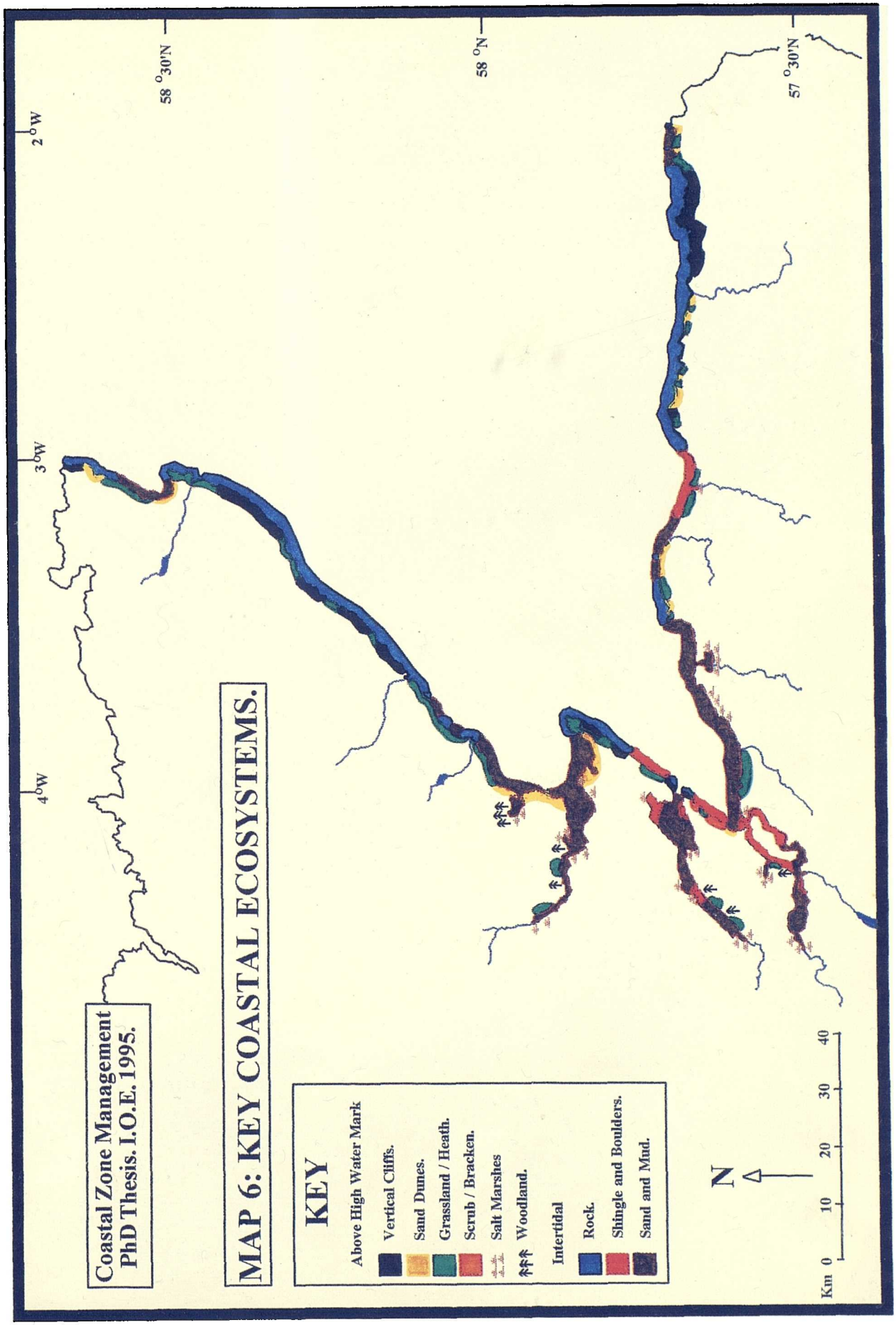
This map illustrates the distribution of key ecosystems within the Moray Firth coastal zone. Above the high water mark these ecosystems include; vertical cliffs, sand dunes, grassland, heathland, scrubland, bracken, salt marsh and woodland. Below the high water mark, the key ecosystems are those composed of; rock, shingle and boulders and sand and mud.

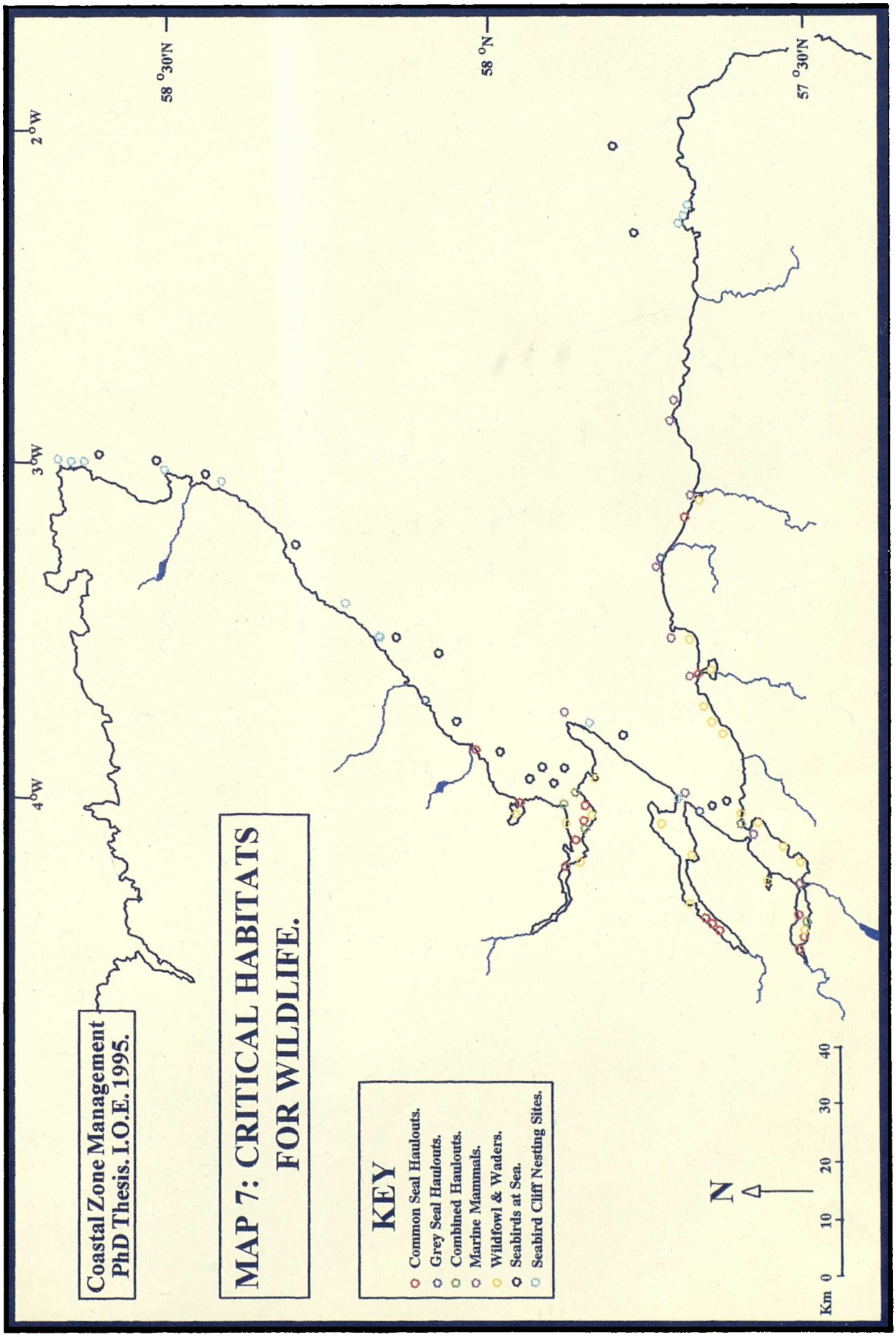
These mapped ecosystems are important for their biological productivity, and particularly their provision of feeding and habitat areas for most of the region's bird species.[9, 15]

3.7. *Map 7: Critical Habitats for Wildlife.*

This map illustrates the distribution of critical habitats and nesting sites for key species or species groups. Important fauna groups include wildfowl species, such as; wigeon (*A. penelope*), mallard (*A. platyrhyncha*), teal (*A. crecca*), red-breasted merganser (*M. serrator*), goosander (*M. merganser*), shelduck (*T. tadorna*) and scaup (*A. marlia*) and wader species such as; oystercatcher (*H. ostralegus*), lapwing (*V. vanellus*), ringed plover (*C. hiaticula*), curlew (*N. arquata*), bar-tailed godwit (*L. lapponica*), redshank (*T. totanus*), knot (*C. canuta*) and dunlin (*C. alpina*). Important species of shorebird include; kittiwake (*R. tridactyla*), razorbill (*A. torda*), guillemot (*U. aalge*), herring gull (*L. argentatus*), greater black-backed gull (*L. marinus*) and fulmar (*F. glacialis*). As for the mammals, the ones most commonly found within the Moray Firth coastal zone are; common seal (*P. vitulina*), grey seal (*H. grypus*), harbour porpoise (*P. phocaena*) and bottlenose dolphin (*T. truncatus*).

All the species mentioned above are of local, national or international importance. Protection of such fauna and conservation of biodiversity in general should be considered as one of the high priorities of coastal zone management. Of particular significance should be any species that are considered to be threatened or vulnerable.[9, 15, 23, 40, 41]


Coastal Zone Management
PhD Thesis. I.O.E. 1995.
MAP 6: KEY COASTAL ECOSYSTEMS.
KEY
Above High Water Mark
Vertical Cliffs.
Sand Dunes.
Grassland / Heath.
Scrub / Bracken.
Salt Marshes
Woodland.
Intertidal
Rock.
Shingle and Boulders.
Sand and Mud.
N
Km 0 10 20 30 40
4°W
3°W
2°W
58°30'N
58°N
57°30'N


Coastal Zone Management
PhD Thesis. I.O.E. 1995.
MAP 7: CRITICAL HABITATS
FOR WILDLIFE.
KEY
Common Seal Haulouts.
Grey Seal Haulouts.
Combined Haulouts.
Marine Mammals.
Wildfowl & Waders.
Seabirds at Sea.
Seabird Cliff Nesting Sites.
4°W
3°W
2°W
58 °30'N
58 °N
57 °30'N
N
Km 0 10 20 30 40

Chapter 4: Uses and Users of the Moray Firth Coastal Zone.

4.1. *Introduction.*

The use of the coast and the perception of the coastal zone as a resource are the focus of Chapter 4. Much of the information presented within this chapter concerning the use of the Moray Firth coastal zone at a local or individual level was derived from the use of questionnaires tailored for each activity described. Examples of these questionnaires can be seen in Appendix 2.

The many uses of the coastal zone have not been constant through time, changing cultural structures and values have ensured that the 'resource' component of the coastal zone has, like the environment itself, been in a state of constant evolution and fluctuation. With increased technological power man has also been able to take a more positive role in shaping the coastal environment to meet his own ends, increasing its resource potential and reducing his susceptibility to hazard.

The extent of the coastline as a whole still generally acts as a limitation to man's coastal zone activities, but this is no longer necessarily true of many other locational factors such as flatland, or sheltered waters. Nevertheless, because of their importance in the past and the forces of locational inertia, many of the historical determinants of coastal use continue to exercise an important influence over the present use of the coastal zone, for example, the inheritance of resorts and ports.

The use of the coastal zone thus has three components; a past dimension which is one of increasing numbers of users, increasing variety of use and increasing impact of use over time; a present dimension which inherits the legacy of the past, as well as adjudicating the values and needs of the present; and a future dimension whose values, opportunities and needs are still largely unknown but for whom it is important to maintain options.[20]

It is difficult to circumscribe coastal zone uses because theoretically most activities could take place in this environment and any classification would tend towards mutual inclusivity. The classification proposed aims therefore to concentrate on those activities either requiring a coastal location or typical of fairly extensive coastal tracts.

The following activities outlined are divided into components of the overall coastal resource, that is, the use of the Moray Firth coastal zone as a 'source', 'sink' or 'link' are simply individual components of coastal resource use as a whole within the Moray Firth.

4.2. *The Coastal Zone: A 'Source'.*

4.2.1. Fisheries.

One of the major activities to depend on the coastal zone as a source is fishing, indeed fish were one of the earliest aspects in man's long association with the coast to be appreciated as a resource.

The importance of the Moray Firth in terms of feeding, spawning and nursery areas for commercial species is shown in Section 3.5, while the five fishing districts of the Firth, that is; Wick, Lossiemouth, Buckie, MacDuff and Fraserburgh, are illustrated on Map 8, Section 4.9.

Landings of commercial fish within the different districts by weight and value are shown in Table 29. This shows that Fraserburgh is the main fishing port within the Moray Firth.

Table 30 which shows landing of pelagic species in each district clearly shows that the main pelagic species caught within the Moray Firth is herring (*C. harengus*), accounting for 12,015 tonnes landed in 1992 out of a total for all species of 13,203 tonnes.

Tables 31 and 32 show the demersal and shellfish landings for each district in the Moray Firth by weight, value and species. The main demersal species landed are; monkfish (*Squatina squatina*), with over 1,000 tonnes landed within Wick and Fraserburgh districts, haddock (*M. aeglefinus*), with over 2,000 tonnes landed within Wick and Fraserburgh districts, cod (*G. morhua*), with almost 2,000 tonnes landed in Fraserburgh district and whiting (*M. merlangus*) with over 4,000 tonnes landed in Fraserburgh district. The main shellfish species landed are; Great and Queen scallops (*Pecten maximus* and *Aequipecten opercularis*), with over 1,000 tonnes landed in Wick District, mussels (*M. edulis*), with over 2,000 tonnes landed within Lossiemouth district and Norway lobster (*N. norvegicus*) with over 3,000 tonnes landed within Fraserburgh district.

Table 33 shows numbers of fishermen employed by district of residence. The total for both regularly and partially employed fishermen in 1992 was 2,893, with Fraserburgh district employing the most people. Table 34 shows the numbers of fishing vessels by size and base district within the Moray Firth. As of 1992 the total was 439 vessels, with MacDuff and Fraserburgh the only districts with vessels over 30m.

Secondary jobs associated with the fishing industry such as processing, storage and marketing are very important within the Moray Firth. There are approximately 31 companies involved in such secondary work areas, employing approximately 2,500 workers.[42, 43, 44, 45, 46, 47]

Table 29: Landing in the Moray Firth Districts & Creeks by Weight & Value 1992.[48]

	Weight (tonnes)				Value (£'000)			
District & Creek	Demersal	Pelagic	Shellfish	All Fish	Demersal	Pelagic	Shellfish	All Fish
Wick	9,331	33	1,391	10,755	11,299.6	11.6	2,238.6	13,549.8
Wick	2,151	8	1,102	3,261	2,187.5	3.7	1,661.5	3,852.7
Lybster	Nil	Nil	4	4	Nil	Nil	5.0	5.0
Helmsdale	61	Nil	8	69	44.6	Nil	11.7	56.3
Lossiemouth	1,281	955	3,170	5,406	1,210.4	181.5	1,258.4	2,650.3
Portmahomack	Nil	Nil	2,452	2,452	Nil	Nil	461.4	461.4
Avoch	204	955	94	1,254	177.1	181.5	132.9	491.5
Inverness	4	Nil	79	83	2.3	Nil	10.3	12.6
Burghead	334	Nil	295	629	316.3	Nil	363.0	679.3
Lossiemouth	738	Nil	250	988	714.7	Nil	290.9	1,005.5
Buckie	1,402	Nil	1,154	2,556	1,490.9	Nil	1,649.5	3,140.3
Buckie	1,401	Nil	1,145	2,546	1,489.7	Nil	1,642.4	3,132.1
Findochty	Nil	Nil	4	4	Nil	Nil	3.5	3.5
Portknockie	1	Nil	4	6	1.2	Nil	3.6	4.7
MacDuff	3,159	11	240	3,410	2,843.7	5.2	289.9	3,138.8
Portsoy	Nil	Nil	6	6	Nil	Nil	5.6	5.6
Whitehills	749	1	95	846	715.8	0.5	98.5	814.8
MacDuff	2,410	10	127	2,546	2,127.8	4.7	173.9	2,306.5
Gardenstown	Nil	Nil	11	11	Nil	Nil	11.9	11.9
Fraserburgh	13,332	13,104	3,503	29,938	13,040.1	1,455.8	4,708.7	19,204.6
Pennan	Nil	Nil	Nil	Nil	Nil	Nil	1.0	1.0
Rosehearty	Nil	Nil	Nil	Nil	Nil	Nil	0.5	0.5
Sandhaven/Pitullie	Nil	Nil	Nil	Nil	Nil	Nil	0.8	0.8
Fraserburgh	13,332	13,104	3,502	29,938	13,040.1	1,455.8	4,706.4	19,204.6

Table 30: Pelagic Fish Landings per District by Weight and Value of each Species, 1992.[48]

Species	Landing Districts									
	Wick		Lossiemouth		Buckie		MacDuff		Fraserburgh	
	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000
Argentines	31	10.5	Nil	Nil	Nil	Nil	10	4.7	8	4.3
Blue Whiting	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Herring	Nil	Nil	955	181.5	Nil	Nil	Nil	0.1	11,070	1,151.2
Mackerel	2	1.1	Nil	Nil	Nil	Nil	1	0.4	2,025	300.3
Sprats	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Other Pelagic	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
TOTAL	33	11.6	955	181.5	Nil	Nil	11	5.2	13,104	1,455.8

Table 31: Demersal Fish Landings per District by Weight and Value of each Species, 1992.[48]

Species	Landing Districts									
	Wick		Lossiemouth		Buckie		MacDuff		Fraserburgh	
	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000
Blue Ling	7	6.1	Nil	Nil	Nil	Nil	Nil	Nil	8	6.0
Brill	Nil	0.2	Nil	0.3	Nil	0.6	Nil	0.2	1	2.0
Catfish	29	32.5	22	25.5	3	3.7	3	3.9	121	135.7
Cod	1,952	2,829.8	136	196.3	177	233.7	209	301.1	1,947	2,586.3
Conger Eel	6	2.9	Nil	Nil	1	0.4	1	0.4	2	0.9
Dabs	50	18.2	20	8.4	23	10.4	54	24.7	44	21.4
Dogfish	407	428.8	297	199.2	94	80.5	742	622.1	708	652.0
Dover Sole	Nil	Nil	Nil	Nil	1	3.4	Nil	Nil	Nil	0.1
Flounder	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.1
Forfbeard	Nil	0.1	Nil	Nil	Nil	Nil	Nil	0.1	Nil	Nil
Greenland Halibut	1	0.9	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Gurnards Red	2	0.8	Nil	Nil	1	0.1	Nil	Nil	Nil	0.1
Haddock	2,259	2,229.8	192	184.9	240	160.6	889	690.8	3,192	2,086.4
Hake	47	76.5	3	4.7	3	3.3	14	16.2	22	31.5
Halibut	4	17.4	1	5.3	1	2.7	Nil	1.8	10	29.4
John Dory	Nil	0.4	Nil	Nil	Nil	Nil	Nil	NIl	Nil	Nil
Lemon Sole	102	153.6	28	48.6	37	63.5	47	104.8	150	290.0

Table 31 continued

Ling	440	418.8	99	95.8	27	25.2	27	30.0	399	380.1
Livers	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.3
Megrims	286	500.1	5	7.5	18	33.4	14	29.8	94	174.5
Monk	1,053	2,685.4	41	89.5	182	439.3	107	269.0	1,198	3,348.1
Plaice	432	405.3	106	90.5	202	168.7	199	178.6	433	385.6
Pollock	101	109.0	131	124.1	12	13.1	6	6.3	79	82.2
Roes	10	11.4	Nil	0.4	1	2.4	3	4.5	5	10.2
Roundnose Grenadier	2	1.1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Redfish	49	26.1	Nil	NIl	Nil	Nil	Nil	Nil	1	0.5
Saithe	672	382.5	26	15.5	29	15.9	11	6.8	388	200.0
Shark	Nil	0.2	Nil	Nil	Nil	0.2	Nil	0.4	1	1.4
Skate	383	278.7	9	5.0	37	20.5	31	17.4	108	56.7
Tusk	19	11.5	4	2.9	Nil	0.3	1	0.8	5	5.5
Turbot	10	38.6	Nil	2.1	4	13.5	1	5.0	15	65.2
Whiting	907	533.9	144	89.4	260	145.4	730	439.7	4,081	2,020.6
Witches	52	61.2	12	12.3	35	39.8	52	71.1	322	467.0
Other Demersal	49	37.7	2	2.2	16	10.3	19	18.2	Nil	0.2
TOTAL	9,331	11,299.6	1,281	1,210.4	1,402	1,490.9	3,159	2,843.7	13,332	13,040.1

Table 32: Shellfish Landings per District by Weight and Value of each Species, 1992.[48]

Species	Landing Districts									
	Wick		Lossiemouth		Buckie		MacDuff		Fraserburgh	
	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000
Cockles	Nil	Nil	135	16.2	Nil	Nil	Nil	Nil	Nil	Nil
Edible Crab	94	84.9	15	12.5	25	17.0	86	60.4	6	2.6
Lobster	13	149.9	1	9.2	Nil	2.9	1	11.2	Nil	2.4
Mussels	Nil	Nil	2,386	438.2	Nil	Nil	Nil	Nil	2	Nil
Norway Lobster	133	282.6	458	599.3	475	648.2	82	136.2	3,003	4,198.5
Octopus	Nil	NIl	Nil	Nil	Nil	Nil	Nil	Nil	31	6.9
Periwinkles	7	3.5	5	2.3	Nil	Nil	3	1.2	Nil	Nil
Pink Shrimp	Nil	Nil	Nil	Nil	30	24.0	Nil	Nil	75	64.6
Scallops	1,042	1,571.1	26	32.0	554	890.5	10	15.3	92	178.8
Squid	83	111.9	66	48.2	67	66.4	41	61.3	130	221.9
Velvet Crab	19	34.7	Nil	0.8	Nil	Nil	1	1.0	Nil	Nil
Whelks	Nil	Nil	Nil	Nil	2	0.4	15	3.4	164	32.8
Other Molluscs	Nil	Nil	77	99.9	Nil	Nil	Nil	NIl	Nil	Nil
TOTAL	1,391	2,238.6	3,170	1,258.4	1,154	1,649.5	240	289.9	3,503	4,708.7
TOTAL FOR ALL SPECIES	10,755	13,549.8	5,406	2,650.3	2,556	3,140.3	3,410	3,138.8	29,938	19,204.6

Table 33: Numbers of Fishermen Employed by District of Residence, 1992.[48]

District	Regularly Employed	Partially Employed	Total
Wick	166	38	204
Lossiemouth	494	26	520
Buckie	516	7	523
MacDuff	634	45	679
Fraserburgh	928	39	967
Totals	2738	155	2893

Table 34: Number of Vessels by Size and Base District, December 1992.[48]

District	< 10m	10-15m	15-20m	20-25m	25-30m	30-35m	> 35m	Total
Wick	57	15	10	3	Nil	Nil	Nil	85
Lossiemouth	10	10	24	44	2	Nil	Nil	90
Buckie	4	4	44	42	1	Nil	Nil	95
MacDuff	5	4	47	34	Nil	5	6	101
Fraserburgh	22	6	37	71	4	6	12	158
Totals	98	39	162	154	7	11	18	439

4.2.2. Aquaculture.

As with the fishing industry mentioned previously, the aquaculture operations of the Moray Firth coastal zone are illustrated on Map 8, Section 4.9.

There are currently three operational inshore fin-fish farms within the Moray Firth.[49] The first is run by a company called 'Black Isle Fish Farms'. Sea cages are located at Avoch Bay, within the Inverness Firth, and are used in the on-growing of atlantic salmon (*S. salar*). The company was established in 1985 and currently employs ten people.[50] The second operation, 'Seaboard Marine Services' operated by Mr A Thoms is also involved in the on-growing of atlantic salmon (*S. salar*), however, this time in sea cages located just south of the entrance to the Cromarty Firth.[51] The third fin-fish farm is run by 'Cromarty Trout Co.', as the name indicates sea cages are located in the Cromarty Firth and used for the on-growing of Rainbow trout (*Salmo gairdneri*).[50] This company is owned by a Mr Robert Davie who also owns 'Black Isle Mussels (Scotland) Ltd' which is discussed over the page.[52]

Onshore, a company called 'Lovat Fisheries' which is located at Beauly is involved with the production of Atlantic salmon (*S. salar*) smolts for the on-growing industry,[53] while at the Alness Industrial Estate, on the north shore of the Cromarty Firth there is an aquaculture company called 'Sargasso Ltd'. This company operates a closed fresh water farming system for the production and processing of eels (*Anguilla anguilla*).[54]

The potential for shellfish farming within the inner Moray Firth has been recognised for some time. The Dornoch Firth, Cromarty Firth, Beauly and Inverness Firths are within an indicative list of areas produced by the Crown Estate which have a 'general presumption in favour of small and medium scale fishfarms'. At the present time there are two operations growing shellfish within the Moray Firth. The first involves the growing of Pacific oysters (*Crassostrea gigas*) on trestles, and Queen scallops (*A. opercularis*) on the seabed within the Cromarty Firth by Mr Robert Davie who, as stated previously, also owns 'Black Isle Mussels (Scotland) Ltd' which markets mussels (*M. edulis*) purchased from the Dornoch Firth mussel fishery, and 'Cromarty Trout Co.'.[52] The second operation is also situated within the Cromarty Firth and involves the growing of Pacific oysters (*C. gigas*), it is run by a Mr Hamish MacKenzie.[55] Elsewhere within the Moray Firth there are several registered but inactive sites for shellfish farms.

Table 35 provides further detailed information concerning the aquaculture operations in the Moray Firth coastal zone mentioned above.

Within the Moray Firth individual farms provide full or part-time employment for only a relatively small number of people when compared to operations on the west coast of Scotland. However, even the small amount of employment that is available has been reduced by the closure of farms. For example, a recent casualty was 'Kincardine Fisheries', which ran fin-fish operations in both the Dornoch and Cromarty Firths.

Table 35: Aquaculture Operations within the Moray Firth Coastal Zone.

Company Name	Foundation Date	Number of Employees	Product	Yearly Production	Distribution
Black Isle Fish Farms	1985	10	On-growing Salmon producers	-	-
Seaboard Marine Services	-	-	On-growing Salmon producers	-	-
Cromarty Trout Co.	-	-	Rainbow Trout	-	-
Lovat Fisheries	1975	9	Salmon smolts	-	-
Sargasso Ltd.	1991	10	Eels	-	-
Mr Robert Davie	-	2	Oysters / Scallops	64000 Oysters	Black Isle Mussels Ltd, - all over UK

Source:[50, 51, 52, 53, 54, 55]

4.2.3. Aggregates.

Aggregates, which include sand, gravel and shell deposits are a further category where the coastal zone acts as a source. However, unlike fish and shellfish resources, aggregates can be exploited both above and below the shoreline. The exploitation of the resource can therefore be divided into onshore and inshore activities.

4.2.3.1. *Onshore Aggregates.*

Quarrying for rock, sand and gravel takes place at several coastal sites around the Moray Firth. These workings mainly provide material for the small local demand. However, there is an increasing demand for supplies of construction material for the south of England and continental markets, and Helmsdale has been suggested as a possible site for a Coastal Supper Quarry.[9]

There are approximately 10 companies involved in mineral and aggregate extraction and supply within the coastal zone of the Moray Firth.[43, 44, 46, 47] Products produced range from sand and drainage material through to concrete blocks and rock armour protection. The amount of material extracted each year is variable, however, two of the companies that replied to the questionnaire sent out, 'John Gunn & Son Ltd' and 'Invergordon Sand and Gravel', stated that they extract 70,000 and 200,000 tonnes of rock and gravel moraine respectively each year.[56, 57]

4.2.3.2. *Inshore Aggregates.*

The search for new sources of construction material, and increasing environmental constraints onshore have led to a move towards looking for sources of aggregate material within the marine environment. This trend has been encouraged by the UK government which, in itself, is expected to increase the demand for material from this source.[9]

The distribution of seabed sediments within the Moray Firth is described in detail in Section 2.2.2.1, and illustrated on Map 3, Section 2.7.

An aggregate extraction licence has been issued for a 20km^2 area 3 to 6km from Spey Bay, outwards from the 18m depth contour. The licence is issued for extraction of 120,000m^3 of course aggregate over 10 years with an annual extraction allowance of 30,000m^3, although exploitation has not yet taken place.[15] This deposit is thought to be an extension of large gravel deposits already identified in land.

4.2.4. Hydrocarbons.

The exploitation of hydrocarbon deposits is a fourth type of source activity within the coastal zone. As with aggregates, these deposits occur on both sides of the shoreline, emphasising the connectivity of the system across the intervening coastline. However, in contrast to fisheries and aquaculture, although bearing some resemblance to aggregates, hydrocarbons are non-renewable on the present time scale, an aspect which has proved critical in their development and management.

Within the Moray Firth, British Petroleum (BP) has developed the Beatrice oil field which is located on the Smith Bank at 58°8'N, 3°05'W, just 22km off the Scottish mainland. It was discovered in 1976 and is the only oil field on the United Kingdom Continental Shelf (UKCS) whose installations can be seen from land. The actual production complex consists of four offshore platforms, including two that are bridge-linked, in a water depth of 46m.[15] Power for these platforms is provided by a subsea power cable running to the platforms from the shore.

Map 9, Section 4.10 illustrates the location of the Beatrice installations within the Moray Firth as a whole.

Lower to Middle Jurassic sandstone's contain oil in the Beatrice field but, the Callovian Beatrice formation sands form the main reservoir with over 79% of the fields reserves.[12] The field covers an area of 5,700 acres lying 2,100m below the seabed.

Production from Beatrice commenced in 1981. Recoverable reserves are estimated at 130 million barrels (approximately 18.5 million tonnes) and the present rate of production from the oil field is 60,000 barrels (approximately 8,000 tonnes) a day. In 1990, 1,183,000 tonnes of oil was produced, bringing the cumulative production total (from 1981-1990) to 15,639,000 tonnes.[9]

A 16 inch diameter pipeline exports oil the 67km to the onshore terminal at Nigg within the Cromarty Firth where it is stored prior to transportation by tanker.[15] The various facilities at the terminal are operated by a consortium of oil companies, which include; Britoil plc. (a subsidiary of BP Petroleum Development Ltd), Deminex UK Oil and Gas Ltd, Kerr-Mcgee Oil (UK) plc., LAMSO North Sea plc. and Hunt Oil (UK) Ltd.

The Beatrice Field is expected to be a forerunner of many medium sized UKCS fields that will need to be developed when the flow from larger fields, further out into the North Sea, declines.

In addition to those within the Beatrice oil field, 29 exploration wells have been drilled within the Moray Firth, including one that resulted in a significant gas discovery at Block A: 12/27.[15]

A 273mm diameter natural gas pipeline for distribution of natural gas to users has been installed by British Gas (Scotland) in a pre-dredged trench in the Inverness Firth across the Kessock Narrows, from Longman Point to the north of Craigton (1.36km in length) and across the Cromarty Firth near the present Cromarty Bridge. Dredged material was used for backfilling the trench or was disposed of in a designated marine spoil ground in the Beauly Firth.[9] This pipeline will now make it economically possible for the first time, to exploit the gas reserves of the Moray Firth.

As with the fishing industry, a large number of secondary jobs have been created by the presence of hydrocarbons within the Moray Firth and the wider North Sea. There are

approximately 43 companies based within the Moray Firth coastal zone that service the oil industry in some way or another.[42, 43, 44, 45, 46, 47]

Services available include; platform fabrication at Nigg and Ardersier, pipeline fabrication and coating at Evanton, Invergordon, Morrich More and Sinclair's Bay, rig inspection, repaire and maintenance within the Cromarty Firth, oil field servicing at Wick and the Cromarty Firth, oil storage at Nigg and a wide range of ancillary services throughout the region.

There has however, been a reduction in the number of such companies in the area due to the recent depressed economic climate and other contributing factors such as the continually low price of crude oil. Notable companies that have moved away from the area include 'Hampco Ltd', 'The Petroprojects Group' and 'British Pipe Coaters'.

4.3 *The Coastal Zone: A 'Sink'.*

4.3.1. Waste Disposal.

It has been suggested that the use of flowing water and the ocean margins as sinks for all kinds of agricultural, urban and industrial wastes is one of the outstanding features of the world's resource processes. Therefore, waste disposal comprises a dominant element in any consideration of coastal zone use.

Wastes are introduced principally from land based sources, but activities on the seabed, vessel source pollution, and airborne sources are also contributory, emphasising once again the connectivity of the system.

The Moray Firth coastal zone comes under the jurisdiction of two of Scotland's River Purification Boards (RPBs). These are North East River Purification Board (NERPB) and Highland River Purification Board (HRPB). Together they are responsible for over 100 sites where outfalls discharge waste, both domestic and trade, into the marine environment. Table 36 over the page outlines the location and degree of treatment occurring at these sites.

Table 36: Consented Domestic & Trade Outfalls along the Moray Firth Coast.[9]

Site	Population	Degree of Treatment	Remarks
Keiss	500	Crude	-
Reiss	200	Settlement	-
Ackergill	100	Septic tank	-
Wick Shaltigoe	2,000	Crude	-
Staxigoe	170	Septic tank	-
Papigoe	190	Septic tank	-
Toftcarl Treat. Works	Unknown	None	-
North Head Wick	6,000	Maceration	-
Latheronwheel	125	Septic tank	-
Lybster	800	Crude	-
Helmsdale	1,600	Crude	-
Portgower	200	Septic tank	-
Brora N^{o} 1	1,400	Maceration	Includes distillery wool mill effluent
Brora N^{o} 2	400	Septic tank	-
Golspie	1,800	None	-
Embo	500	Septic tank	-
Dornoch	1,000	Settlement tank	Discharge to Black Burn
Bonar Bridge	1,030	Septic tank	Discharges to Kyle of Sutherland
Ardgay	400	Septic tank	-
Edderton	350	Septic tank	-
Tain	4,000	Biological treatment	-
Portmahomack	550	Septic tank	-
Balintore	2,000	Biological	-
BP Exploration	Trade	Oil sep., sand filtration & biological treatment	-
Barbaraville	200	Septic tank	-
Saltburn	400	None	-
Invergordon Rosskeen	6,000	Macerator & long outfall	Designed to serve Invergordon & Saltburn
Glenmorangie Distil.	Trade	None	-
Balblair Distillery	Trade	None	-
Invergordon West	1,030	None	-
Invergordon Distillery	Trade	Dark grains plant to treat pot ale	-
Dalmore Distillery	Trade	None	-
Polar Distri., Services Ltd Conon Bridge	Trade	Screening, air flotation & chemical flocculation	Fish processing factory discharges to River Conon
United Malt & Grain Distillers Ltd Teaninich	Trade	Dark grains plant to treat pot ale	-
Alness	3,800	Macerator & long outfall	-
Evanton Industrial Est.	Unknown	None	-
Dingwall	6,200	Biological treatment	Discharge to mouth of River Peffery
Conon Bridge	1,150	Biological treatment	Discharge to River Conon
Maryburgh	1,100	Septic tank	Discharge to River Conon
Culbokie	540	Septic tank	-
Jemimaville	200	Septic tank	-
Cromarty Trout Co Ltd	Trade	None	Sea cages. Consent for 200 ton., an., prod.
Cromarty	775	None	-
Fortrose / Rosemarkie	1,500	Maceration	-
Avoch	1,200	None	Unsatis., new treat. works being designed
Black Isle Fish Farms	Trade	None	Caged-fish farm

Table 36 continued

Munlochy	500	Full biological treatment	-
Kessock, Craigton	1,500	Maceration	-
Beauly	1,100	Full biological treatment	-
Muir of Ord (new sewer)	2,500	Septic tank	Improvements programmed
Muir of Ord (old sewer)	Unknown	Evaporation	Distillery effluents
Dalcross	200	Septic tank	-
Christian, Dalcross	Trade	Screening	Cold store process effluent
Longman	40,000	None	Unsatis., improvement urgently required.
Allanfearn	7,500	Primary Settlement	-
Ardersier	1,350	None	Unsatis., new treat. works being designed
McDermott's Fabrication Yard	Variable (when operational)	Full biological treatment	-
Nairn, Altonburn	420	Septic tank	-
Nairn, East Beach	8,000	Primary settlement	Secondary treatment required to meet bathing directive guidelines
Forres	1,000	Full biological treatment	-
Kinloss	4,020	Full biological treatment	-
Burghead	Trade	Maceration	Emergency discharge of pot ale and routine drainage of other distillery effluents
Cumingston	200	None	Unsatisfactory - improvements awaited
Hopeman	1,710	Septic tank	Recently extended
Brackla Distillery	Trade	None	Distillery process effluents, outfall unsatisfactory - improvements awaited
Lossiemouth Harbour	3,000	None	Gross solids have been seen on East Beach
Lossiemouth Shore St.	5,500 + Industry	Comminution	-
Elgin long sea outfall	35,000	Screening & grit removal	-
Portgordon N^{o} 1	800	None	-
Portgordon N^{o} 2	850	None	-
Portgordon Maltings	18,780	Activated action to sludge	Discharged from ratch process
Buckie Outfalls 1-10	14,650	None	Rationalisation required
6a, 8a, C, G			6a - G above low water mark
Findochty 1 (Edindoun)	1,515	Comminution	Dye tests show effluent enters harbour
Findochty 2 (Harbour)	176	None	-
Findochty N^{o} 3	320	None	Amenity area - pump to N^{o} 1
Findochty N^{o} 4	440	None	Amenity area - pump to N^{o} 1
Portknockie	1,300	None	Inaccessible discharge point
Cullen N^{o} 1	280	None	-
Cullen N^{o} 2	1,250	None	Recently extended below low water. May affect harbour water quality
Sandend	310	Settlement	Amenity beach
Portsoy Doonie Point	1,500	None	Dye tests show sewage entering harbour
Portsoy New Harbour	200	None	Requires extension
Portsoy Links Bay	200	None	Amenity area. To be abandoned with effluent being pumped to New Harbour
Whitehills Low Shore	980	None	Dye tests show extension and comminution required
Whitehills Harbour Place	30 + fish processing	None	Being extended below low water
Inverboyndie (Ladysbridge)	Hospital + Water Works Sludge	None	-
Banff Scotstown	200	None	Above low water, complaints received
Banff Harbour	5,180	None	Screening proposed but outfall positioned too close to harbour mouth
MacDuff, The Lip	1,500	None	Rationalisation required

Table 36 continued

MacDuff, Bankhead	960	None	Rationalisation required
MacDuff Distillery	6,000	Balanced over 24 hours	Discharged to River Deveron estuary
MacDuff, Craig Fauld	3,000 + Industry	Maceration	Rationalisation required
Gardenstown, Seatown	328	None	-
Pennan	100	Mutrators	Storm overflow requires improvement
Rosehearty	1,260	None	Gross poll., occurring complaints received
Sandhaven	890	None	2 separate outfalls, Sandhaven and Pitullie
Fraserburgh	14,000 persons + 10,000 trade	None	Gross pollution occurring - designated beach nearby

The dumping of maintenance dredgings from ports and harbours as well as engineering works, also takes place within the Moray Firth coastal zone. There are currently four licences in operation covering five designated dumping sites, all of which are located in the southern part of the Moray Firth. These five sites are illustrated on Map 9, Section 4.10.

4.4 *The Coastal Zone: A 'Link'.*

4.4.1. Ports.

Ports, or more correctly, sea ports, represent a major class of coastal zone use for which a coastal location is by definition a necessity.

The main shipping port within the Moray Firth is the Invergordon port complex within the administrative area of the Cromarty Firth Port Authority. Specifically, this complex consists of a number of piers, docks and moorings, including; the Admiralty Pier, Service Base and Queen's Dock, Saltburn Pier, Nigg Oil Terminal, Firth (anchorage and moorings), Highland Fabricators, Highland Deephaven and the Ferry Terminal.[51]

The Cromarty Firth Port Authority which is responsible for the port complex at Invergordon was set up by the Cromarty Firth Port Authority Order Confirmation Act 1973, as an Authority –"responsible for the improvement, conservancy, management and development of the Cromarty Firth." Jurisdiction of the Authority extends approximately 2.5 miles from the shore.[9]

Table 37 over the page shows Cromarty Firth Port Authority statistics for Invergordon between 1986 and 1994.

Table 37: Cromarty Firth Port Authority, Invergordon - Statistics, 1986-94.[51]

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994
N° of Ships	451	412	683	571	494	594	863	868	873
Tonnage G.R.T.	2646400	1930132	2660849	2173890	1962406	2256407	3035587	2719302	3855160
Crude Oil	2102647	1573894	1396829	1307954	1174198	1004694	709112	914641	2152122
Wheat & Maize	29216	30759	33289	5264	11750	2312	2445	16543	12452
Malting Barley	45662	50625	51376	30431	9179	32321	29476	20136	9259
Bare Pipes	2504	Nil	Nil	2700	5203	2054	9502	6853	19733
Coated Pipes	2836	Nil	3470	5766	8666	8503	36284	9213	33602
Salt	29167	30908	12870	10367	26392	34719	16990	41396	53763
Bunkers	13255	13409	21240	19958	4287	10525	19819	16503	17568
Timber	Nil	4100	7572	21484	19507	22432	9886	1772	3629
O.R.E.	16276	10777	36470	30393	18583	19663	17247	15891	31267
Scrap	13146	12044	11605	11246	7112	21008	18179	9747	15058
Coal	11000	20828	79508	9266	17514	38495	Nil	24533	8343
Shotblast	7255	5307	5164	8845	9292	8784	7524	5782	4842
Cement	4354	2252	515	Nil	2675	Nil	Nil	Nil	Nil
Steel & Fabs.	12577	10632	23058	17528	9433	36627	20004	24732	23469
Potatoes	1110	878	853	803	507	365	1209	1541	2026
Fertiliser	577	1463	20738	21834	14716	11492	24926	25475	27403
Frozen Fish	1703	6178	10871	2602	6455	7265	6042	1341	901
Malt	Nil	3499	3400	10384	11546	10440	10168	1171	6000
Fishmeal	Nil	2291	9396	10294	10854	10407	6732	7623	11746
Potash	Nil	581	1493	6286	2162	1105	Nil	3258	Nil
Wet Fish	166	Nil	Nil	Nil	12	Nil	231	1381	951
Cattle Feed	Nil	Nil	3194	7229	3007	2038	5814	621	Nil

The bulk of the cargo shipped through the Invergordon port complex is crude oil exported from the Nigg Oil Terminal by tanker. The remainder of the shipments comprise cereal goods, minerals, general goods, offshore supplies and refined oil. In addition a local ferry opperates between Nigg and the town of Cromarty, mainly transporting emplyee's to and from the Nigg Oil Terminal.

The Invergordon port complex has also played a key role in the development of North Sea oil and gas fields in its role as a rig service and repaire base. Facilities are available for inspection, repaire and maintenance (IRM), refit and lay-up. As of February 1995, 361 rigs had entered the Firth since quiet beginnings in 1978.[49]

Additional significant shipping activity also occurs at Inverness and Wick harbours.[15] Inverness harbour is a Harbour Trust owned and operated by a board of Harbour Trustees,

established by an Act of Parliament in 1847. In Caithness, Wick harbour is also a Harbour Trust, involved in general cargo and oil related activities.[9]

The main marine traffic routes run parallel to each coastline and across the approaches of the Moray Firth. These shipping lanes area are illustrated on Map 9, Section 4.10.

Within the Moray Firth coastal zone as a whole, ports range in size from those which can take commercial and oil related traffic such as Invergordon, Inverness and Wick, and to some extent Fraserburgh and Burghead, to those of mainly fishing importance such as Buckie, MacDuff and Lossiemouth.

Within Grampian Region, Grampian Regional Council acts as Harbour Authority for ten harbours long the Moray Firth coastline. These are the general cargo and fishing ports of Buckie, Burghead and MacDuff and the smaller recreational harbours of Banff, Cullen, Findochty, Hopeman, Portknockie, Portsoy and Rosehearty.

Harbours not controlled by the Council include; Lossiemouth (fishing), Fraserburgh (fishing and commercial), Whitehills (fishing), Gardenstown (fishing and recreation) and Findhorn, Portgordon, Pennan and Sandhaven (recreation).

A number of harbours, piers, slipways and jetties used mainly for small scale fishing operations as well as recreational activities are located within Highland Region. These include the harbours at Portmahomack, Nairn, Fortrose, Golspie, Brora, Helmsdale, Latheronwheel and Dunbeath, and the jetties and slipways at north and south Kessock, Chanonry, Rosskeen, Balblair, Embo, Littleferry and Keiss.[9]

4.4.2. Communications.

4.4.2.1. *Land.*

On land the coastal zone of the Moray Firth is served by both road and rail networks. Map 9, Section 4.10 illustrates the major communication routes around the Moray Firth, which are also discussed below.

4.4.2.1.1. Road Network.

The main road that serves the northern flank of the Moray Firth is the A9(T). For the majority of its route this road follows the coast, connecting Inverness to John O Groats via;

the Kessock Bridge over the Inverness Firth, the bridges over the Cromarty and Dornoch Firths, and the towns of; Golspie, Brora, Helmsdale, Dunbeath, Lybster and Wick. At both Latheron and Wick roads move inland to connect the Moray Firth coastline to the north coast of Scotland at Thurso.

The southern flank of the Moray Firth is served by a number of smaller roads. Of these, the main ones are; the A96(T) which connects Inverness to Elgin via Nairn and Forres, the A941 which connects Elgin to Lossiemouth, and the A98(T), B9139 and B9031 which link the towns of the Banff and Buchan coastline, from Buckie to Fraserburgh.

4.4.2.1.2. Rail Network.

The rail network also runs from Inverness to Wick along the northern flank of the Moray Firth. However, unlike the A9(T), the rail line does not hug the coast for the majority of its route. From Inverness the line follows the southern shore of the Beauly Firth until Beauly itself, it then cuts north to Dingwall via the Conon Bridge and thus bypasses the Black Isle completely. Leaving Dingwall, the line then follows the northern shore of the Cromarty Firth, passing through Evanton and Invergordon, before moving inland to join up with the southern shore of the Dornoch Firth at Tain. From here the line progresses inland following the southern shore of the inner Dornoch Firth, past the Kyle of Sutherland and on inland to Lairg Station. At this point the line returns to the coast, following the course of the River Fleet until it reaches Loch Fleet. The coastline is skirted at Golspie, from where the coast is followed closely until Helmsdale is reached via Brora. At Helmsdale the line once more moves inland and forms a wide arc until it reaches the coast once more at Wick, where this part of the line terminates. As with the road network, Wick is again connected to Thurso, this time via a branchline from Georgemas Junction Station.

Along the southern flank of the Moray Firth, very little of the coastal zone is served by the rail network. The line departs from Inverness and closely follows the route of the A96(T), connecting Inverness to Elgin via Nairn and Forres. Halfway between Forres and Elgin a branchline cuts north to connect the mainline to Burghead. Once past Elgin the line moves sharply inland to connect Keith to Aberdeen, visiting none of the Banff and Buchan coastline.

4.4.2.2. *Sea.*

As stated previously, the main shipping lanes run parallel to each coastline and across the approaches of the Moray Firth, this is illustrated on Map 9, Section 4.10.

4.4.2.3. *Air.*

Two commercial airports service airlines in the Moray Firth coastal zone. These are Wick Airport and Inverness Airport. There are also two RAF airfields present, at Kinloss and Lossiemouth (see Section 4.8).

4.5 *The Coastal Zone: A 'Haven'.*

4.5.1. Conservation.

Conservation is a response not only to the qualities of the coastal zone but also to the variety of other uses which impinge upon the natural environment.

Protection for the natural environment has been traditionally sought in the UK by statutory designation (see Section 5.4.8). In Scotland, these designations are mostly identified and managed by Scottish Natural Heritage (SNH) which is Scotland's statutory conservation agency, however, non-statutory designated conservation also occurs. For example, bird reserves run by the Royal Society for the Protection of Birds (RSPB) and wildlife reserves run by the Scottish Wildlife Trust.

Map 10, Section 4.11 outlines the marine and coastal protected areas of the Moray Firth.

4.6 *The Coastal Zone: An 'Amenity'.*

4.6.1. Recreation

The majority of information on the distribution and degree of recreation is contained within studies carried out for large geographic areas such as regions or districts. There is little or no information specifically for coastal areas such as the Moray Firth. To add to this problem of limited information, there is little published information available on the unorganised and informal uses of the coastal zone by individuals, as opposed to those activities carried out by groups that often require specific facilities.

Therefore, to overcome these and other problems questionnaires were sent out to all the recreational users of the Moray Firth it was possible to locate, that is, both clubs and individuals, asking them to provide information about their activities and their interactions with other users (see Section 4.1).

Map 11, Section 4.12 illustrates the locations where recreational activities discussed below take place within the Moray Firth. These recreational activities can best be divided for the purposes of discussion into those that are land based and those that are water based.

4.6.1.1. *Land Based Activities.*

4.6.1.1.1. Golf.

The game of golf was been played in Scotland since the early fifteenth centuary and to this day remains a very popular sporting activity. This is illustrated by the fact that there are some 28 golf clubs and 31 courses located within the coastal zone of the Moray Firth.[58] The approximate membership of these clubs is some 12,400, which again illustrates the popularity of the game in Scotland. The majority of these clubs provide their members with; a club house with changing facilities, equipment storage, equipment hire, a pro-shop, catering, a bar and free car parking.

Table 38 gives more detailed information concerning each individual club that responded to the questionnaire sent out.

Table 38: Golf Clubs within the Moray Firth Coastal Zone.

Club Name	Foundation Date	Membership	Waiting List	Ownership	SSS	Facilities Available
Wick	1870	300	No	-	69	Ch. Lr. St. Cp. Br. Ca. T.
Lybster	1926	70	No	Private owner	62	ChF. Cp.
Helmsdale	1895	50	No	Club	62	ChF. Cp.
Brora	1891	500	-	-	69	Ch. Lr. Br. R. Es. Cp.
Golspie	1889	400	-	Club	68	Ch. ChF. Br. Ca. Ps. Cp
Royal Dornoch	1877	1300	No	District Council	66	Ch. ChF. St. Br. Ca. Cp.
Bonor-Bridge	1904	247	No	Club	63	Ch. ChF. Ca. Cp.
Tain	1890	480	No	District Council	70	Ch. ChF. Br. Ca. Es. Cp.
Tarbat	1909	170	-	Club	63	Ch. ChF. St. Br. Cp.
Alness	1904	171	No	Private Owner	63	Ch. ChF. Br. Cp.
Fortrose & Rosemarkie	1888	750	Yes	Club	69	Ch. ChF. St. Br. Cp.
Muir of Ord	1875	700	-	Club	65	Ch. ChF. St. Br. Ps. Cp.
Inverness	1883	1100	-	Club	70	Ch. Lr. Br. Ps. Cp.
Nairn-Dunbar	1899	900	Yes	District Council	72	Ch. ChF. Lr. Br. Ca. Ps. Cp.
Nairn	1887	1128	Yes	Club	71	Ch. ChF. Lr. Br. Ca. Ps. Cp.
Forres	1889	920	Yes	Club	69	Ch. ChF. Lr. Br. Ca. Ps. Cp.
Hopeman	1900	600	Yes	Club	67	Ch. ChF. Br. Cp.
Moray	1889	1500	Yes	Club	72 / 69	Ch. ChF. Br. Ca.
Garmouth	1931	476	No	Club	67	Ch. ChF. Br. Ca. Cp.
Spey Bay	-	260	No	Crown Estates	69	Club is part of Spey Bay Hotel. ChF. Cp.
Buckpool	-	500	-	District Council	70	Ch. ChF. St. Ca. Br. SqC. Ps Cp.
Strathlene	1879	450	No	District Council	69	Ch. ChF. Lr. Br.
Cullen	1870	712	No	Club	62	Ch. ChF. Lr. Br. Ca. Cp.
Duff House Royal	1910	750	-	Club	69	Ch. ChF. St. Br. Ca. Ps. Cp.
Royal Tarlair	1926	600	No	Club	68	Ch. ChF. St. Br. Cp.
Rosehearty	1970	200	No	District Council	-	Ch. ChF. Cp.
Fraserburgh	1881	700	No	Club	70	Ch. Cp.
Inverallocy	-	400	-	Club	65	Ch. ChF. Ca. Cp.

Ch = Club House, ChF = Changing Facilities, Lr = Locker Room, St = Storage, Br = Bar, Ca = Catering, Es = Equipment Shop, Ps = Pro Shop, SqC = Squash Courts, Cp = Car Park. SSS = Standard Scratch Score.

Source: **59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,78, 79, 80, 81, 82, 83, 84, 85, 86**

4.6.1.1.2. Wildfowling

Upon the areas of foreshore within the Moray Firth owned by the Crown Estate, the Crown retains the rights by which members of the public may engage in wildfowling between September the 1st and February the 20th each year. As a result, wildfowling takes place on much of the intertidal area of the Moray Firth, with particularly concentrated activity occurring around the Beauly Firth, Munlochy Bay and Findhorn Bay areas. Having said this however, this public right does not extend to the coastline of Sutherland and parts of Ross and Cromarty District, where private ownership extends down to the mean low water spring tide level.[87]

At the present time there are five wildfowling clubs and associations operating within the Moray Firth coastal zone. These are; the Dornoch and Cromarty Firths Wildfowlers Association, the Black Isle and Mid-Ross-shire Wildfowlers Club, the Inverness and District Wildfowlers Association, the Forres, Nairn and District Wildfowlers Association and RAF Rough Shoot Club.[88] Much of the shooting within the Moray Firth is carried out by the members of these clubs and associations, but there has also been a significant increase in wildfowling pressure in recent years from non-local wildfowlers and independent wildfowlers.

Associated with this increase have been reports of bad shooting practice. These include reports of; shooting too high resulting in winged birds, disturbing roost sites, the leaving of spent cartridges, shooting too close to residential areas and large numbers of wildfowlers concentrated in the same area.[89] Although the local clubs and associations closely monitor their own members to avoid such bad practice, they are relatively powerless when dealing with outsiders. Having said this, the majority of all wildfowlers are represented by a national body, the British Association for Shooting and Conservation (BASC).

4.6.1.1.3. Other Activities.

As to be expected, like any other part of the UK there are also the more typical activities occurring in the Moray Firth, that is, such activities as; football, rugby, tennis, squash and bowls etc. There are also those activities that require no club structure in order to safely

enjoy the activity, and therefore make it very difficult to come up with a comprehensive assessment of their distribution. For example, walking is a popular activity around both low-lying and higher cliff areas and as such occurs over much of the Moray Firth coastline.

4.6.1.2. *Water Based Activities.*

4.6.1.2.1. Yachting / Sailing.

There are seven yachting / sailing clubs that operate within the Moray Firth.[90] These seven clubs have approximately 900 members. Table 39 gives more specific information about each individual club that responded to the questionnaire sent out.

Table 39: Yachting / Sailing Clubs within the Moray Firth Coastal Zone.

Club Name	Foundation Date	Member-ship	Ownership	Training Courses	Facilities Available
Chanonry Sailing Club	1956	250	Highland Reg. Council	Yes (RYA)	Ch. ChF. M. Sw. Cp. Bp.
Invergordon Boating Club	1903	50	Private Owner Mr Gill.	Yes (RYA)	Ch. ChF. Ca. St. M. Sw. Cp. Bp.
Nairn Sailing Club	-	-	-	-	-
Royal Findhorn Yachting Club	1931	400	Club	Yes	Ch. ChF. St. Br. Ce. M. Cp.
Lossiemouth Sailing Club	1973	80	Private owner Capt Dunbar.	No	Ch. ChF. Ce. Cp. Bp.
Findochty water Sports Club	1983	41	Grampian Reg. Council	Yes (RYA)	Ch. St. Sw. Cp. Bp. Race Buoys.
Banff Sailing Club	-	60	Club	Yes (RYA)	Ch. St. Br. Ce. Sw. Cp. Bp

Ch = Club House, ChF = Changing Facilities, St = Storage, Br = Bar, Ca = Catering, Ce = Club Equipment, M = Mooring, Sw = Slipway, Cp = Car Park, Bp = Boat Parking. Source:**91, 92, 93, 94, 95, 96**

4.6.1.2.2. Canoeing.

The records of the Scottish Canoe Association indicate that there are six canoe clubs that operate specifically within the Moray Firth coastal zone. The total membership for the five clubs that responded to the questionnaire is 182. Further details about the activities of these clubs are given in Table 40 over the page.

Table 40: Canoe / Kayak Clubs within the Moray Firth Coastal Zone

Club Name	Foundation Date	Member-ship	Training Courses	Sites Canoed	Facilities Available
Caithness Kayak Club	1979	50	Yes	Kessock to Duncansby Head, + Local Rivers	Canoe Storage Safety Gear
East Sutherland Canoe Club	-	45	Yes	Little Ferry, River Findhorn & Bay	Canoe Storage
Inverness Canoe Club	1993	30	Yes	Most of inner Firths, Nairn & Lossiemouth	Club Kayaks
Findhorn River Runners	-	-	-	-	-
Kinloss Canoe Club	-	17	Yes	Findhorn Bay, Cullen Bay, Buckie area	Club Equipment
Moray Canoe & Kayak Club	1990	40	Yes	All along Moray Coastline.	Club Equipment

Source:[97, 98, 99, 100, 101]

4.6.1.2.3. Jet Skiing.

There are no formal jet ski clubs in the Moray Firth. However, there are approximately half a dozen regular jet skiers who ski within the Moray Firth coastal zone, although this number does rise slightly in the summer months due to visiting skiers.[102] Popular areas within the Moray Firth for jet skiing include; the Beauly Firth, Nairn beach, Lossiemouth east beach, Embo and Dunbeath Harbour.[103, 104, 105]

4.6.1.2.4. Sub-Aqua.

Like jet skiing, sub-aqua diving is a very mobile sport that does not necessarily require the support of a club structure. As a result, it is difficult to identify all the individuals taking part in the sport. Five clubs have been identified that dive on numerous sites within the Moray Firth.[106] These include; the Alford and Grampian branches of the Scottish Sub-Aqua Club (SSAC), and local clubs at Buckie, Huntly and Lossiemouth.[107]

4.6.1.2.5. Sea Angling.

It is difficult to assess how many sea angling clubs there are in the Moray Firth, mainly because the Sea Anglers Federation refuses to divulge such information to members of the public.[108] However, as Map 11, Section 4.12 illustrates, sea angling is a popular sport

which occurs throughout the Moray Firth, both from the shore and from boats offshore. To date only two clubs have replied to the questionnaire sent out, they have a total membership of 52 people. Details of their activities can be found in Table 41 below.

Table 41: Sea Angling Clubs within the Moray Firth Coastal Zone.[109, 110]

Club Name	Foundation Date	Membership	Facilities Available	Fishing Sites (S = Shore, OS = Off Shore)
East Sutherland Sea Angling Club	1975	40	Boat hire, Storage. Slipway. Winch.	**S:** Portmahomack, Tarbet Ness, Embo, Meitle Ferry. **OS**: Four mile radius of Brora Harbour.
RAF Kinloss Sea Angling Club	Prior to 1975	12	Club House, Tackle, Boat.	**S**: Hopeman Harbour, Sand End Portknockie. **OS**: Hopeman, Helmsdale, Buckie, Whitehills, Cullen.

4.6.1.2.6. Bathing.

In the summer months the majority of the sandy bays of the Moray Firth are used for bathing. However, only three beaches are designated as Bathing Beaches under the EC Bathing Beaches Directive, these are; Nairn, Cullen and Fraserburgh beaches.

4.6.1.2.7. Other Activities.

Other activities such as; speed boating, water skiing, wind surfing and surfing also take place in the Moray Firth. However at present, because of their unorganised nature it is difficult to obtain an accurate picture of activity scale or distribution.

4.6.2. Tourism.

There are numerous recreational and amenity sites around the coast of the Moray Firth which attract tourists each year to the area. Map 11, Section 4.12 identifies sites of special interest to tourists. Specifically, the map shows that there are 39 caravan sites along the Moray Firth coastal zone, 35 camping sites, 10 picnic areas and 12 castles or historic houses.

The coastline and marine environment of the Moray Firth provide opportunities for both passive and active forms of outdoor sport and recreational pursuits.[15] The nature of the coastal geomorphology of the area provides a considerable number of beaches, many of

which are well suited to informal recreational use, being sandy, safe and with easy access and car parking, in addition those of the inner Firth are also relatively sheltered. Such access points to the marine environment also enables more active water based pursuits, such as sailing and scuba-diving.

The rich wildlife resource in the coastal zone also encourages visitors to the area, wildlife boat trips to see both bird colonies and marine mammals presently operate from Helmsdale and the Cromarty Firth, while the rich and varied landscapes of the area are a recognised attraction.[9] Popular view points are also illustrated on Map 11.

4.7 *The Coastal Zone: A 'Settlement'.*

4.7.1. Residence.

The coastal zone, the 'most lived in environment on the planet' encompasses a considerable amount of land in residential use, usually double the average concentration of urban development, as a response to the wide variety of coastal zone activities and the attractions of the natural environment. Therefore, it is no surprise to find that the Moray Firth coastal zone is the most populated area of the Scottish Highlands. The major coastal settlements of the Moray Firth and their respective populations are listed in Table 42.

Table 42: Major Coastal Settlement of the Moray Firth.[111, 112]

Caithness District	**Population**
Wick	8728
Lybster	1346
Sutherland District	**Population**
Helmsdale	902
Brora	1860
Golspie	1647
Dornoch	2063
Ross & Cromarty District	**Population**
Tain	4166
Invergordon	4140
Alness	5907
Cromarty	895
Fortrose	1809
Munlochy	588
Avoch	1048

Table 42 continued

North Kessock	1328
Inverness District	**Population**
Inverness	42914
Ardersier	1454
Nairn District	**Population**
Nairn	1560
Moray District	**Population**
Findhorn	660
Burghead	1470
Hopemen	1450
Lossiemouth	7350
Buckie	8450
Findochty	1050
Portknockie	1230
Cullen	1440
Banff & Buchan District	**Population**
Portsoy	1850
Whitehills	960
Banff	4130
MacDuff	4040
Gardenstown	800
Rosehearty	1250
Sandhaven	890
Fraserburgh	13080

4.7.2. Industry.

The main areas of industrial development are concentrated within the inner Moray Firth area, with the most heavily developed area being the Cromarty Firth. Here suitable building land and access to deep water has provided a focus for development which has taken advantage of existing port facilities. Within the Moray Firth coastal zone as a whole, industry development occurs at; Ardersier, Inverness (mainly Longman Bay), Evanton, Alness, Invergordon, Nigg, Tain, Wick (Airport industrial estate) and Sinclair's Bay.

The most important industry types within the Moray Firth coastal zone, excluding those associated with hydrocarbons, aquaculture operations and the fishing industry mentioned previously, are spirit distilling and brewing, woollen and leather goods manufacture and the timber industry. There are approximately 14 companies involved in spirit distilling and brewing which are located within the Moray Firth coastal zone, employing roughly

500 people, approximately 12 companies involved in woollen and leather goods manufacture employing roughly 600 people and approximately 9 companies involved in timber industry employing roughly 400 people.[42, 43, 44, 45, 46, 47]

A special case is British Aluminium who operated an aluminium smelter at Invergordon, which closed down in 1981. British Alcan presently own the Invergordon Aluminium Smelter buildings and land and the factory is being maintained in a condition which would allow reuse as a smelter.[9]

4.8 *The Coastal Zone: A 'Defence'*

4.8.1. Military Activities.

Defence has long been of key importance in the coastal zone particularly given our island location and Britain's history as a major maritime and naval power. Today defence remains a major land use, amounting at the last major review to some 662,000 acres excluding HM dockyards and port installations. Many of these acres are in coastal locations, and are used for a variety of functions.

Within the Moray Firth, the Ministry of Defence (MoD) has a number of different facilities. Map 9, Section 4.10 identifies the location the military installations and training grounds within the Moray Firth coastal zone. These include the RAF bombing range at Morrich More (RAF Tain) which is one of the most heavily used aerial weapons ranges in the UK, mainly due to its close proximity to Lossiemouth airfield and low-flying areas.[9] Firing and bombing ranges can also be found at Dingwall, offshore of Rosehearty and at Binn Hill which is on the western shore of Spey Bay.

Military facilities and equipment stores are located at Invergordon, which in the past was used extensively by the Royal Navy for such things as refuelling and resupply, Inverness, Fort George and Milltown. As for the two airfields mentioned briefly in Section 4.4.2.3, RAF Kinloss is the RAF's principal anti-submarine warfare base, while RAF Lossiemouth is the most northerly operational RAF airfield in the UK. Finally, in addition to the above installations and ranges, both surface and submerged submarines exercise frequently in an area just east of the Smith Bank.[15]

4.9. *Map 8: Major Coastal Uses 1.*

This first coastal users map is concerned solely with the fishing and aquaculture industries of the Moray Firth. The five fishing districts are illustrated, as well as areas where specific commercial species are caught, for example, Norway lobster (*N. norvegicus*) and lobster (*H. gammarus*). The main fishing ports of the Moray Firth are also indicated. As for the aquaculture industry, the main sites for fin-fish are shellfish farming are pinpointed.[9, 15, 50, 52, 53, 54, 55]

4.10. *Map 9: Major Coastal Uses 2..*

This is the second of the 3 maps illustrating the different uses to which the coastal resource of the Moray Firth is put. Illustrated on this map are; industrial sites, pipelines, dumping areas, military areas and road, rail and sea communication routes.[9, 15, 10, 23, 41, 113]

4.11. *Map 10: Marine and Coastal Protected Areas.*

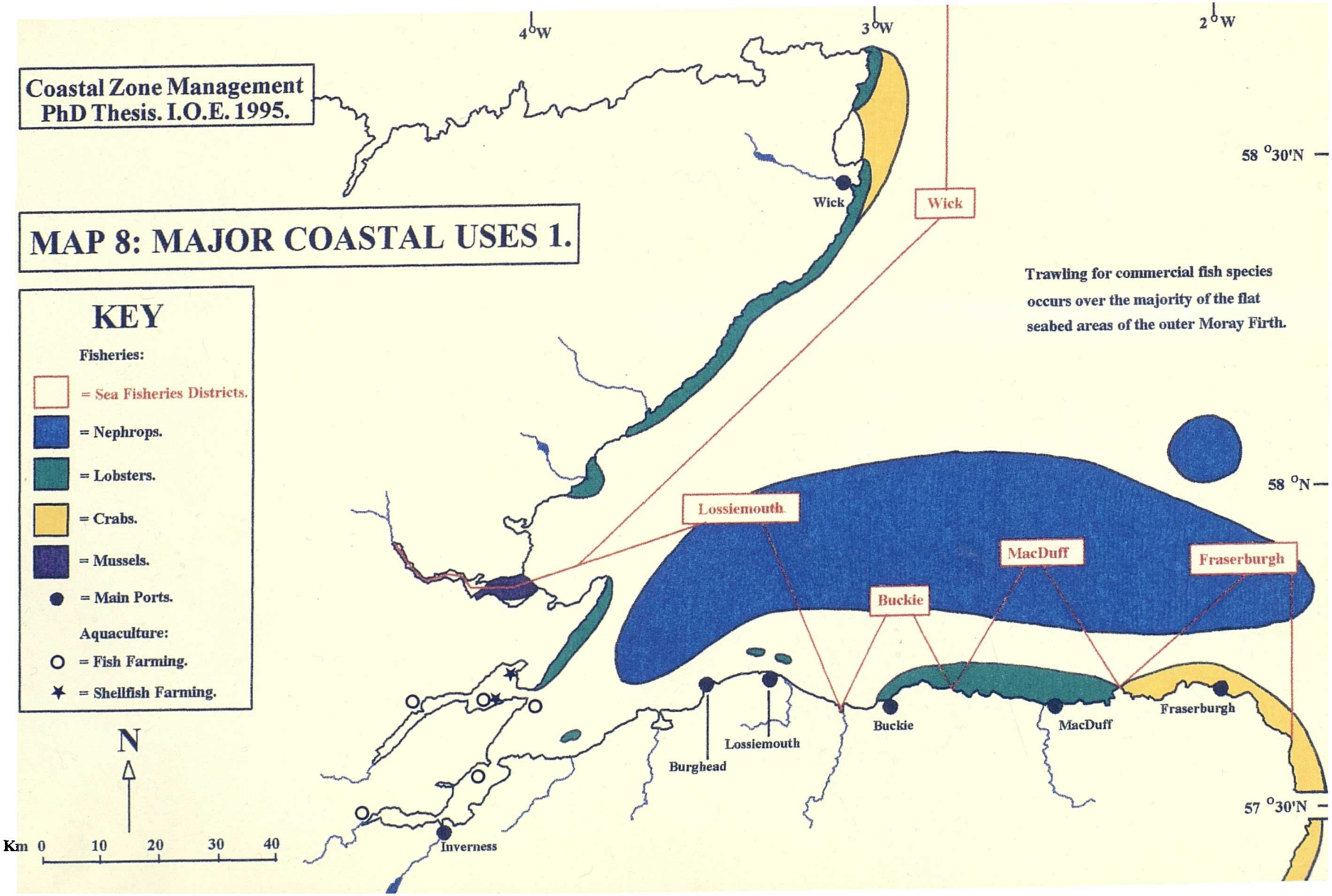
This map shows the locations of existing and proposed marine and coastal protected areas within the Moray Firth. All of the areas shown have a coastal component, the majority stretching down to the mean low water spring tide level. However, there are no fully marine protected areas below the low water spring tide level within the Moray Firth.

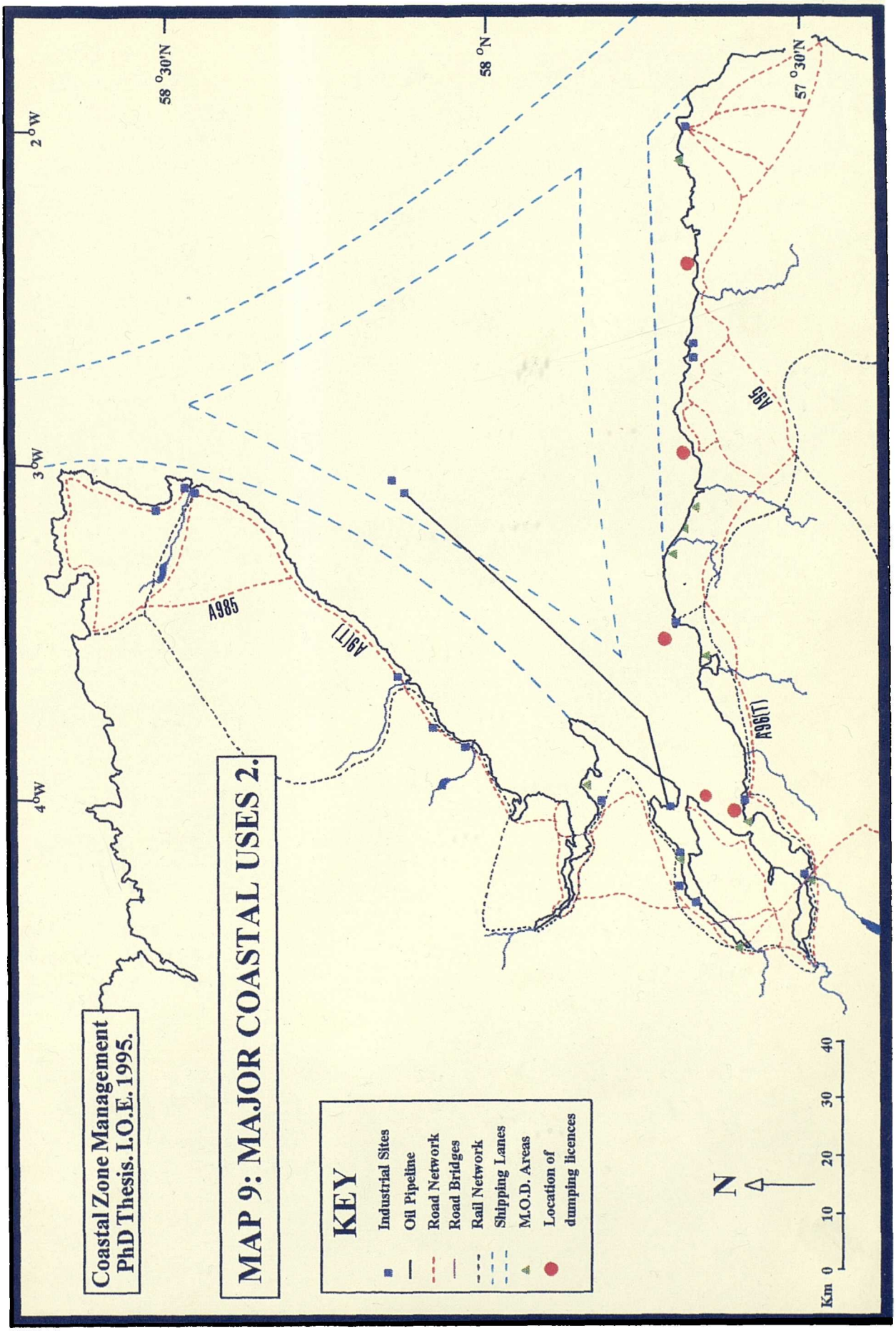
Protected areas are usually designed to protect important natural resources. At the same time they provide a focus for management efforts to avoid, minimise and reconcile the often conflicting needs of conservation and development.[9, 23, 40, 41]

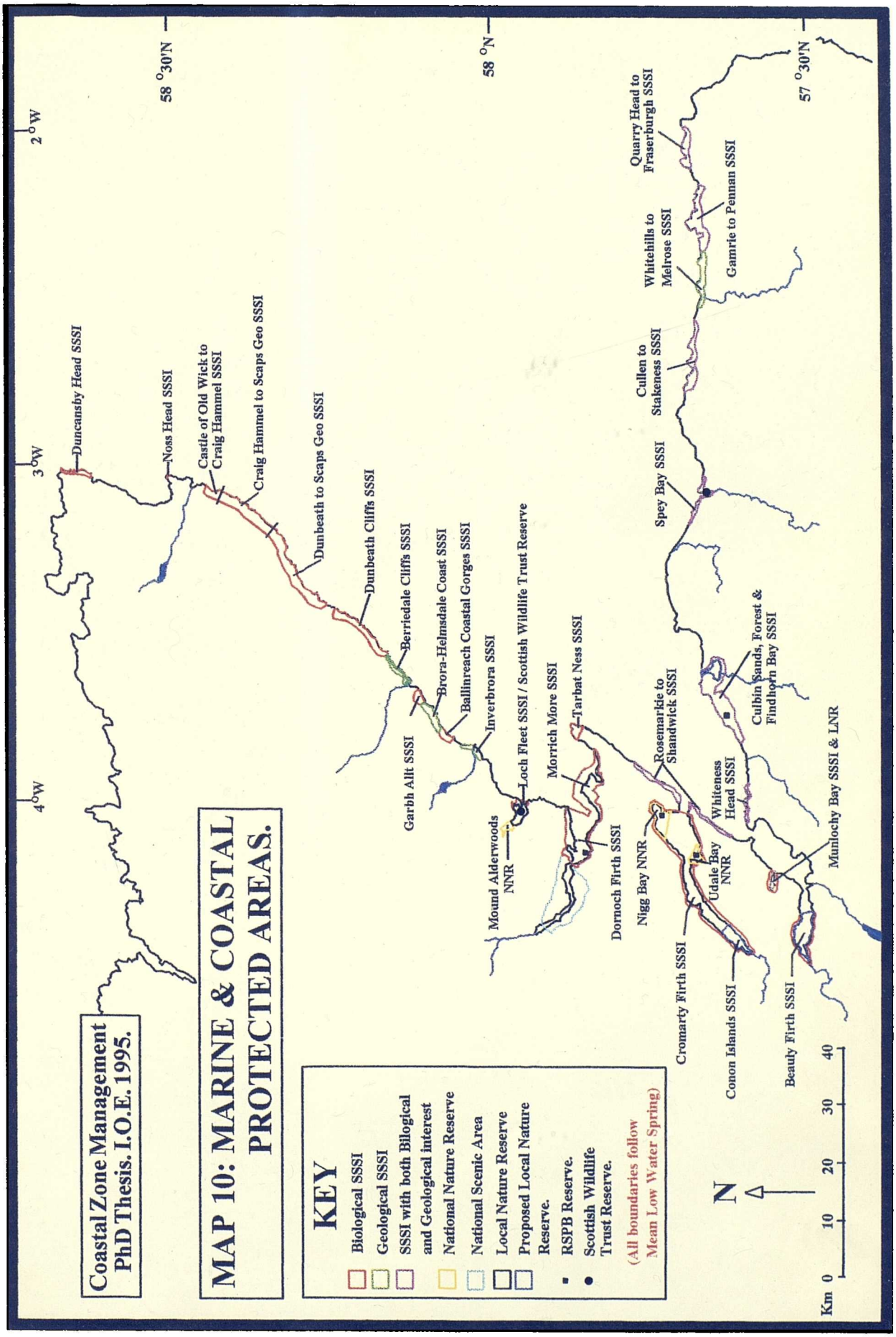
4.12. *Map 11: Major Coastal Users 3.*

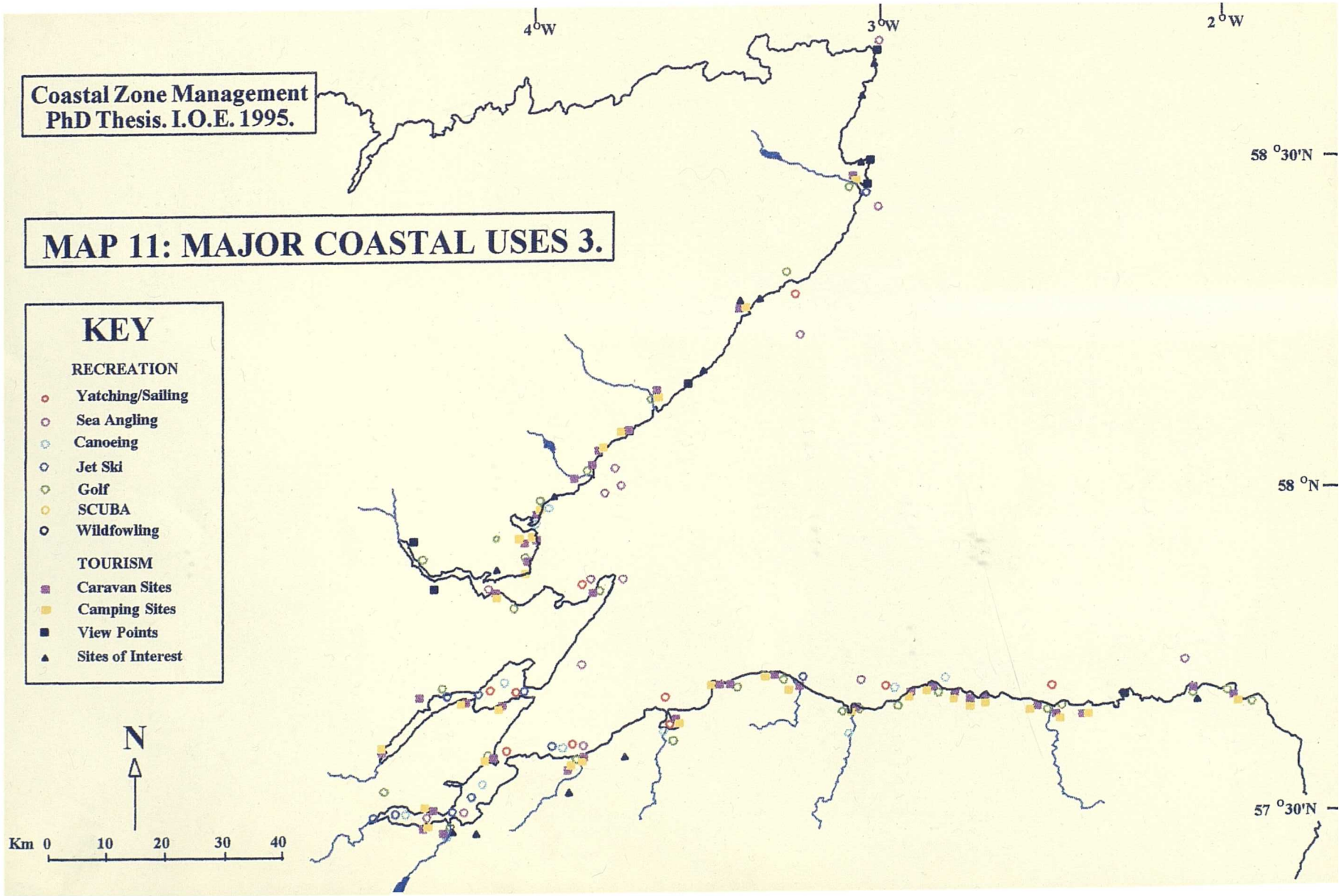
The third map of the major uses of the Moray Firth coastal zone represents the rather more leisurely activities of recreation and tourism.

One of the main assets of living within Moray Firth coastal zone are the many and varied opportunities for undertaking outdoor activities. These can range from the leisurely; walking, camping or caravaning, to the more active; sailing, jet skiing and diving.[9, 15, 10, 58, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 109, 110, 114, 115]


Coastal Zone Management
PhD Thesis. I.O.E. 1995.
MAP 8: MAJOR COASTAL USES 1.
KEY
Fisheries:
= Sea Fisheries Districts.
= Nephrops.
= Lobsters.
= Crabs.
= Mussels.
= Main Ports.
Aquaculture:
= Fish Farming.
= Shellfish Farming.
N
Km 0 10 20 30 40
4°W
3°W
2°W
58 °30'N
58 °N
57 °30'N
Wick
Wick
Trawling for commercial fish species occurs over the majority of the flat seabed areas of the outer Moray Firth.
Lossiemouth
MacDuff
Fraserburgh
Buckie
Buckie
MacDuff
Fraserburgh
Lossiemouth
Burghead
Inverness


MAP 9: MAJOR COASTAL USES 2.
Coastal Zone Management
PhD Thesis. I.O.E. 1995.
KEY
Industrial Sites
Oil Pipeline
Road Network
Road Bridges
Rail Network
Shipping Lanes
M.O.D. Areas
Location of dumping licences
N
Km 0 10 20 30 40
2°W
3°W
4°W
58°30'N
58°N
57°30'N
A985
A96(T)
A95


Coastal Zone Management
PhD Thesis. I.O.E. 1995.
MAP 10: MARINE & COASTAL
PROTECTED AREAS.
KEY
Biological SSSI
Geological SSSI
SSSI with both Bilogical and Geological interest
National Nature Reserve
National Scenic Area
Local Nature Reserve
Proposed Local Nature Reserve.
RSPB Reserve.
Scottish Wildlife Trust Reserve.
(All boundaries follow Mean Low Water Spring)
4°W
3°W
2°W
58 °30'N
58 °N
57 °30'N
Duncansby Head SSSI
Noss Head SSSI
Castle of Old Wick to Craig Hammel SSSI
Craig Hammel to Scaps Geo SSSI
Dunbeath to Scaps Geo SSSI
Dunbeath Cliffs SSSI
Berriedale Cliffs SSSI
Birora-Helmsdale Coast SSSI
Ballinreach Coastal Gorges SSSI
Inverbrora SSSI
Loch Fleet SSSI / Scottish Wildlife Trust Reserve
Morrich More SSSI
Tarbat Ness SSSI
Garbh Allt SSSI
Mound Alderwoods NNR
Dornoch Firth SSSI
Nigg Bay NNR
Rosemarkie to Shandwick SSSI
Cromarty Firth SSSI
Udale Bay NNR
Whiteness Head SSSI
Conon Islands SSSI
Beauly Firth SSSI
Munlochy Bay SSSI & LNR
Culbin Sands, Forest & Findhorn Bay SSSI
Spey Bay SSSI
Cullen to Stakeness SSSI
Whitehills to Melrose SSSI
Gamrie to Pennan SSSI
Quarry Head to Fraserburgh SSSI
N
Km 0 10 20 30 40


Coastal Zone Management
PhD Thesis. I.O.E. 1995.
MAP 11: MAJOR COASTAL USES 3.
KEY
RECREATION
Yatching/Sailing
Sea Angling
Canoeing
Jet Ski
Golf
SCUBA
Wildfowling
TOURISM
Caravan Sites
Camping Sites
View Points
Sites of Interest
N
Km 0 10 20 30 40
4°W
3°W
2°W
58°30'N
58°N
57°30'N

Chapter 5: Examination of the Existing Planning & Management Regime of the Moray Firth.

5.1. *Introduction.*

A degree of basic information has now been complied which draws upon the collation of existing data, original research and consultation. The preceeding chapters have provided a description of the Moray Firth coastal zone in terms of the physical and biological environment and major use types. This next chapter moves on to an examination of the existing planning and management regime within the Moray Firth as it relates to the coast.

Planning and management in the terrestrial and marine environments have evolved in isolation of one another, therefore, there is one planning and management system in place above the low water mark and another regime present for the adjacent inshore waters.

The town and country planning system regulates most activities on the landward side of the low water mark at a regional and district level, with strategic planning guidelines and guidance being provided at national level. This system itself is possible on land because land is capable of being divided into discrete packets in identifiable ownership.

As far as the seaward side of the low water mark is concerned, the situation is completely different. Here, as opposed to the land, areas can not be divided into discrete packets, different areas may be more or less subject to particular uses, but division along rigid boundaries is impractical. Therefore, management and regulation systems have developed that are targeted at particular activities rather than on defined areas.[116]

Below the existing management and planning regimes of both the landward and seaward side of the low water mark are investigated, starting with the landward side.

The Terrestrial Environment.

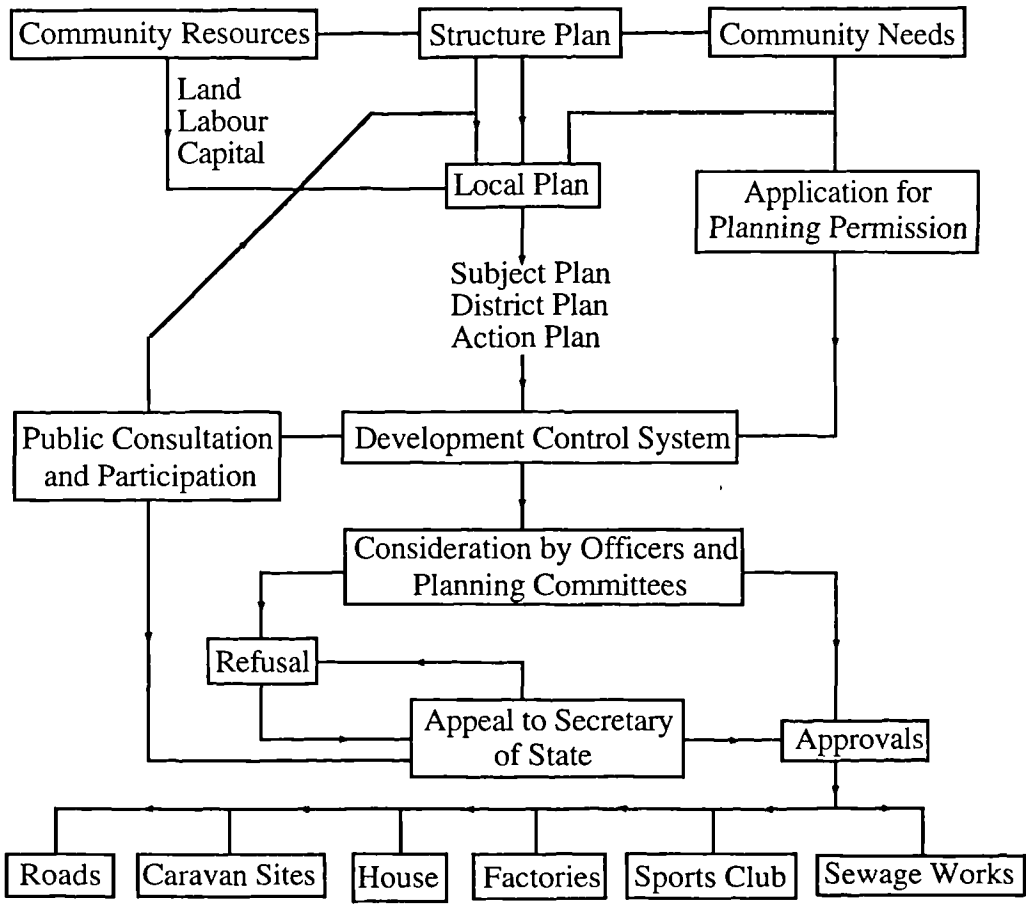
5.2. *Local Government Planning.*

The need to protect the rural and coastal environment from uncontrolled urban and industrial development has existed in Scotland, as in the rest of Britain, for many years. In the late 1940's, a series of reports prepared for the government on land use planning

resulted in national legislation for town and country planning in 1947. Since that time, the spread of economic and social development has continued to extend the need for protective measures and careful planning in rural and coastal areas. To this end, reorganisation of local government planning authorities took place in 1975. Prior to this, a regional framework was not available to planning authorities in the remoter Highland areas.[117]

Prior to local government reorganisation in 1975, the previous planning authorities prepared Development Plans for their areas. From 1975 a new system of development planning came into operation based on Regional Reports and Structure Plans, prepared by Regional and General Planning Authorities, and Local Plans, prepared by District and General Planning Authorities.[118] This system is outlined in Figure 4 below.

Figure 4: The Planning Process.[119]



5.2.1. Regional Reports.

The Regional Report was required to summarise the state of the newly formed authorities and to indicate the main policies and priorities for the consideration of the Secretary of State for Scotland. Within the Moray Firth, the responsibility for the preparation of Regional Reports and Structure Plans is shared between Highland and Grampian Regional Council's.[117]

5.2.2. Structure Plans.

A principal part of a Structure Plan is what is termed the Report of Survey. In terms of the Town and Country Planning (Scotland) Act 1972, Regional Planning Authorities and General Planning Authorities have a duty to institute a survey of their area and to examine and keep under review:

- The principal physical and economic characteristics of the area.
- The size, composition and distribution of population in the area.
- The communications, transport system and traffic needs of the area.

The Report of Survey is critically and crucially relevant in providing justification for the resultant policies and proposals in the Structure Plan itself. A copy of the Report of Survey must be submitted to the Secretary of State for Scotland, and must also be made available to the general public.

The Structure Plan itself is defined in the 1972 Act as –"a written statement formulating the local authorities policy and general proposals in respect of the development and other use of the land (in its area) including measures for the improvement of the physical environment and the management of traffic." This written statement can contain or be accompanied by diagrams, illustrations and maps which explain or illustrate in a general way the proposals in the plan.

As part of the official formulation procedure for a Structure Plan, there is a statutory right for members of the public to have the opportunity to be involved in their preparation and to influence the final policies and proposals. Before a Structure Plan is approved, the Secretary of State for Scotland must consider any objections received to the plan. This

may or may not be done via an Examination in Public (EIP). However, because Structure Plans are not specific, but instead deal with general statements, objections also must be to general policies and proposals. The place for specific objections to particular proposals is the Local Plan Inquiry.[118]

5.2.3. Local Plans.

Highland Region as a General Planning Authority is responsible for the preparation of Local Plans and also development control in the coastal districts of Nairn, Inverness, Ross and Cromarty, Sutherland and Caithness. In contrast, in Grampian Region the responsibility for Local Plans and development control within the Moray Firth is shared between the District Council's of Moray and Banff and Buchan.[117]

However, this situation will change in April 1996 as a result of Local Authority reorganisation. The present two tier structure will be replaced by a single tier structure, with the three new Unitary Authorities of Highland, Moray and Aberdeenshire Council's acting within the Moray Firth.

As with the Structure Plan in terms of the 1972 Act, District Planning Authorities and General Planning Authorities have a duty to institute a Report of Survey of their area for the purpose of preparing a Local Plan, and, to keep under review those matters that are considered necessary by the authority concerned. However, in contrast to the position for Structure Plans, there is no requirement for a Local Plan Report of Survey to be published, or for it to be submitted to the Secretary of State for Scotland.

The Local Plan itself is defined in the 1972 Act as –"a map and a written statement, which formulate the authorities proposals for the development and other use of land (in their area) including measures to improve the physical environment and the management of traffic."

A Local Plan can be expected to provide site specific policies and proposals for commercial, industrial and housing developments, for open space and recreational provision and communication patterns.

Unlike Structure Plans which only vary in terms of the size of geographical area covered, there are three specific types of Local Plan:

- District Plans: Usually comprehensive plans for a part or whole of an authorities area.
- Action Area Plans: Plans for areas earlier identified in the Structure Plan as requiring development, redevelopment or improvement.
- Subject Plans: Plans setting out policy on a particular issue, e.g. aggregate extraction.

However, despite the flexibility originally envisaged in the above system, attention has to date been more or less exclusively fixed on District Plans.

As in the case of the Structure Plan, there is a legal requirement on the part of the authority concerned to ensure 'adequate publicity' in the preparation of their Local Plan. Again, as with the Structure Plan, members of the public have a statutory right to influence the matters which will be the concern of the plan and the resultant policies and proposals.

Although members of the public have this right to influence the content of the Local Plan as participants in the planning process itself, there is also a statutory right for the public to be able to make objections in respect of the plan. These objections are heard at a Local Plan Inquiry, but only if the objector wishes. Such an inquiry will be set up by the planning authority concerned, and will normally be chaired by an independent official from the Scottish Office Inquiry Reporters Unit. A code of practice for such Local Plan Inquiries was prepared in 1977, it seeks to achieve fairness, openness, impartiality and informality so that objectors, even if not represented or not assisted by experts, are not placed at a disadvantage.

Responsibility for the adoption of a Local Plan normally rests with the planning authority concerned, which is obliged only to consider the Local Planning Inquiry Report, and not necessarily to comply with its recommendations. However, the Secretary of State for Scotland retains certain reserve powers in respect of the adoption of Local Plans.[118]

At this present moment, the Moray Firth coastal zone is covered by two Structure Plans and ten Local Plans:

- Highland Region: Structure Plan - adopted 1990
  Local Plans (8):
  Caithness East - adopted 1987

	Helmsdale & Brora	- adopted 1983
	Golspie & Lairg	- adopted 1983
	Easter Ross	- adopted 1992
	Black Isle	- adopted 1994
	Beauly & District	- adopted 1988
	Inverness, Culloden & Ardersier	- adopted 1994
	Nairn Area	- adopted 1983
• Grampian Region:	Structure Plan	- adopted 1994
	Local Plans (2):	
	Banff & Buchan	- adopted 1993
	Moray District	- adopted 1993

5.2.4. Coastal Planning.

In order to identify the role of District and Regional Council's in planning and management at the coast within the Moray Firth, it was decided to survey the appropriate Council's via the use of a written questionnaire.

The questionnaire, reproduced in Appendix 3, was based on a similar one used by Halliday (1986), to survey Local Council's in the coastal zone of England and Wales in a study of their area, organisation and attitude to coastal zone management.

The questionnaire was sent out to the seven District Council's and two Regional Council's present within the Moray Firth. These were, the District Council's of; Caithness, Sutherland, Ross & Cromarty, Inverness, Nairn, Moray and Banff and Buchan, and the Regional Council's of Grampian and Highland.

Towards the end of 1994, completed questionnaire's were received from Highland Regional Council, Grampian Regional Council, Moray District Council and Caithness District Council. However, the results from the Caithness questionnaire were deemed worthless as all the questions had been either answered in the negative, left blank or termed 'not applicable', with no detail information being provided at all.

Banff and Buchan District Council returned their questionnaire uncompleted along with a letter stating that due to the pressure of work commitments, time was not available to complete the questionnaire.[120]

A letter was also received form Inverness District Council's office of the Director of Administration. This letter surprisingly stated that it was believed that Inverness District Council had no involvement with matters referred to in the questionnaire, and that whilst part of the District was indeed a coastal area along part of the Moray Firth, there were no specific policies relating to coastal areas.[121] As a result the questionnaire had been returned uncompleted.

Follow up letters, reproduced in Appendix 3, were then sent out to the remaining District Council's that had not returned the questionnaire. However, as a result of this no more questionnaire's were returned.

In a last effort following a number of telephone calls to the Council's concerned, a shortened version of the questionnaire, also reproduced in Appendix 3, containing just four questions was sent to the remaining Council's, including Caithness, Inverness and Banff and Buchan District Council's. Banff and Buchan District Council was the only Council to reply, answering the four questions and providing a copy of its 1986 Coastal Survey, which answered a number of the questions set in the original questionnaire.

Therefore, completed questionnaires or the equivalent, were received from four out of the nine Council's present within the Moray Firth. However, valid information regarding coastal planning within the Moray Firth by local government was still obtained due to which four Council's replied. These were the two Council's responsible for the preparation of Structure Plans within the Moray Firth, that is, Highland Regional Council and Grampian Regional Council, and the three Council's responsible for the preparation of Local Plans, that is, Moray and Banff and Buchan District Council's, and also Highland Regional Council, in its capacity as General Planning Authority for the coastal districts of Nairn, Inverness, Ross and Cromarty, Sutherland and Caithness,[117] producing Local Plans for each District. In addition, these Council's are the ones that will still be in existance,

although in altered form, following the local government reorganisation in April 1996. Specifically, Highland Regional and Moray District Council's will become the new Unitary Authorities of Highland Council and Moray Council, while Grampian Regional and Banff and Buchan District Council's will both become part of the new Unitary Authority of Aberdeenshire Council.

The results of the survey questionnaire's are summarised below, with the discussion following the organisation of the questionnaire.

5.2.4.1. *Section A: Identification of a Coastal Zone.*

The first two questions concerned the delimitation of coastal zones and the existence of specific coastal policies. However, due to the tenuous nature of the distinction between an area as the adjudicator of policy and a policy with areal implications, the answers received were applicable to either question. Therefore, the answers to the first two questions were combined as a composite response to a revised enquiry.

> A1 / 2. Does your Council delimit (i.e. define an area with boundaries on a map) a coastal zone for any of its activities, or produce any policies which are specifically aimed at the coast ?
>
> Yes / No.
>
> If your answer is 'No', please go on to Question A3.
>
> If your answer is 'Yes', please expand.

All four of the respondents had either a policy or a zone concerned with the coastal zone. This compares favourably with a similar study carried out by Halliday (1986) for Local Council's within the coastal zone of England and Wales. Here, over one third of all respondents had no coastal policies or zones.

Both Banff and Buchan and Moray District Council's stated that they delimited a coastal zone area in terms of Local Plan policies. In both cases the Council departments recognising the coastal zone are the Planning Departments. Within Banff and Buchan the zone is outlined in maps comprising the 1986 Coastal Study (see Figure 5), policies from which are carried forward through the Local Plan process,[122] described previously, while in Moray District, the zone is delimited in the Local Plan Proposal Map (see Figure 6).[123]

Figure 5: Delimited Coastal Zone within Banff & Buchan District.[122]

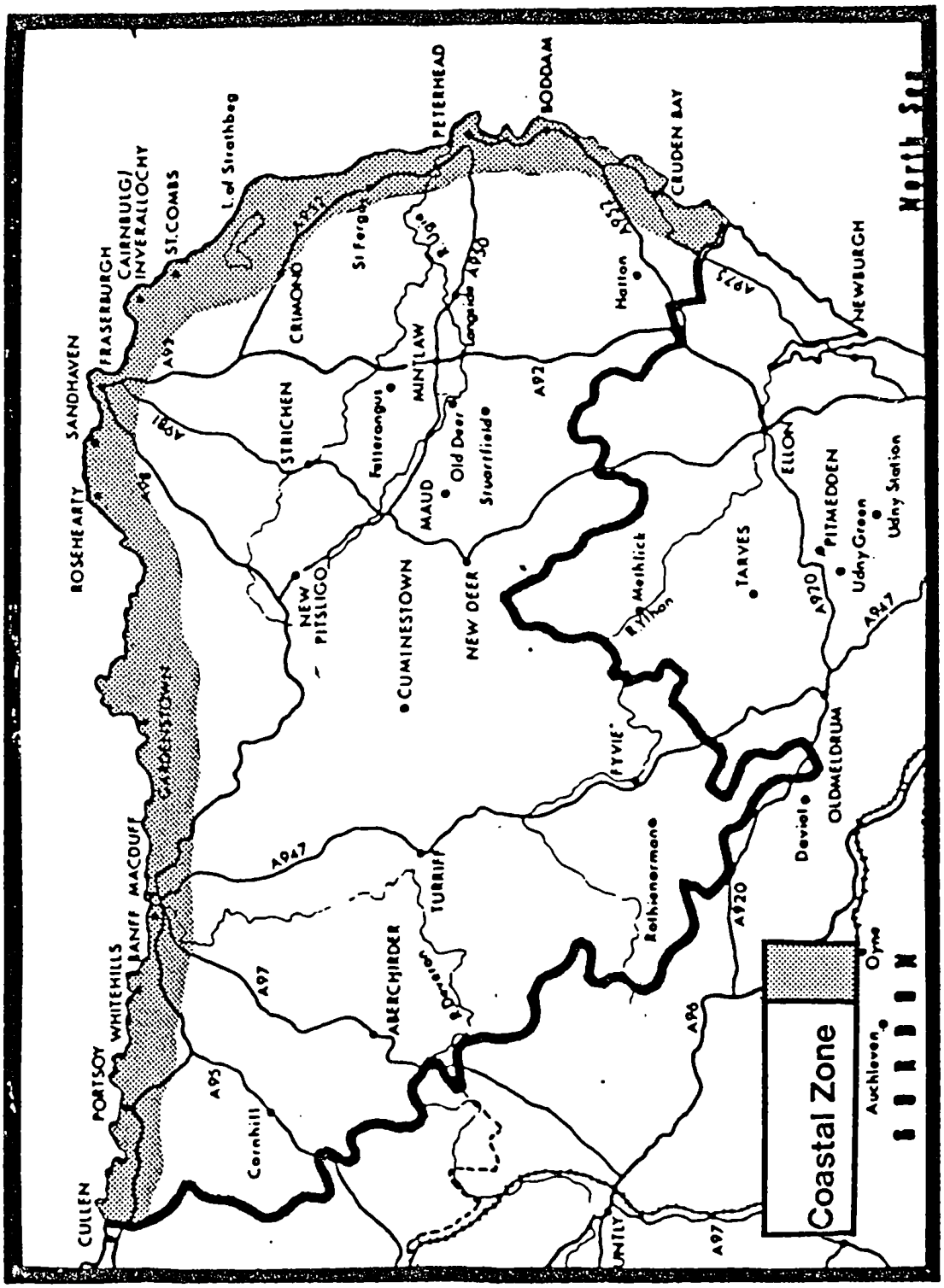
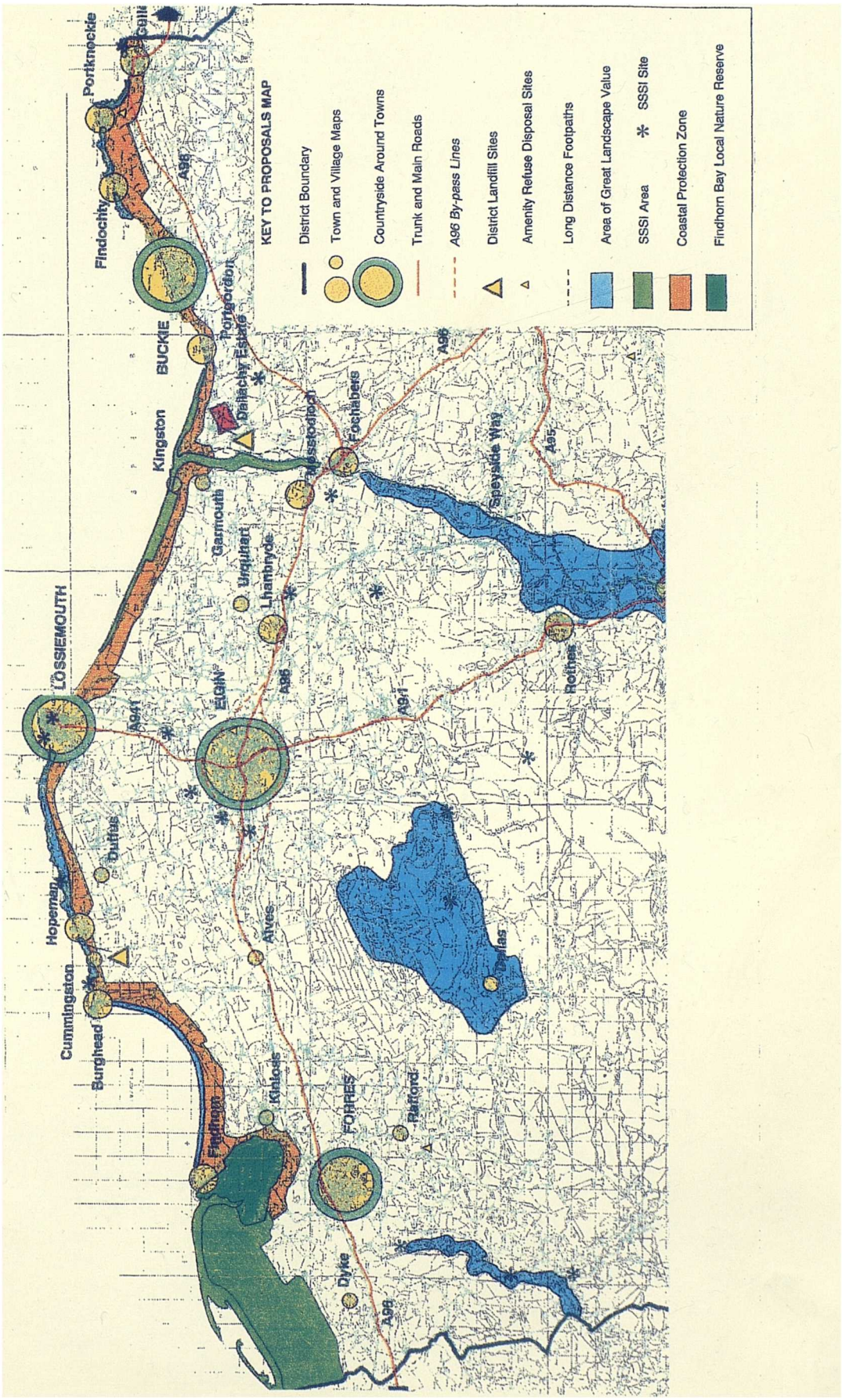


Figure 6: Delimited Coastal Zone within Moray District.[123]



Highland Regional Council stated that the Council's policies and activities involving coastal areas take place within an 'implicit' rather than 'explicit' recognition of their coastal location.[124]

Within all four Council areas, the coast has acted to influence Council policy, responses fell into six main categories; land use planning, nature conservation, recreation / tourism, pollution control, coast protection and industry (mainly fishing).

A3. Can you indicate what priority your Council gives to the coast ?
High / Medium / Low.

Respondents were next asked to indicate the priority their Council attached to the coast. Both Grampian and Highland Regional Council's accorded a high status to their coast, while Moray District Council accorded a medium status. Banff and Buchan District Council was not asked this question in the shortened follow up questionnaire, however, as the only Council to have produced a Coastal Study of its area, it was considered that the Council gave high priority to its coastline.

Reasons for the allocation of priority were not requested, however, the Coastal Study compiled by the Banff and Buchan District Planning Department (1986) stated that the coastal zone of the District was considered important due to its considerable scenic and ecological importance, as well as for its economic interests, notably tourism, agriculture and fishing.[122]

A4. Would you include the coast as one of the five most important policy areas facing your Council ?

Yes / No.

Regardless of the answer above, please list the five most important policy areas facing your Council (N°1 being the most important, and so on down to N°5).

N°1 / N°2 /N°3 / N°4 / N°5.

The final question in this introductory section was included as an alternative measure of the significance of the coast to the Council's. Here, the significance of the coast is considered in a Regional / District wide context.

Both Grampian Regional and Moray District Council's, which had previously accorded a high and a medium priority respectively to their coasts now stated that the coast was not one of the five most important policy areas facing them. In response to the second part of the question, their most important policy areas in diminishing importance were; employment opportunities, housing provision and management in the countryside, pollution control, tourism development and nature conservation and protection.[123, 125]

Highland Regional Council, which had previously accorded a high priority to their coastline, also stated that the coast was one of the five most important policy areas facing the Council. However, once again the term 'implicitly' was used, indicating that the coastal area in its own right is not considered a policy area. The Council failed to offer an answer to the second part of the question.[124]

Banff and Buchan District Council was not asked this question in the shortened follow up questionnaire, after failing to fill out the original questionnaire due to work commitments.

5.2.4.1.1. Summary.

The general impression gained from the fist section of the questionnaire is that there appears to be a split within the Moray Firth regarding the attitude of the Regional and District Council's to the coast.

On one side there is Highland Regional Council, acting as General Planning Authority for the coastal districts of Nairn, Inverness, Ross and Cromarty, Sutherland and Caithness.[117] Here, within the framework of the Local Plans produced for these district's by Highland Regional Council, policies and activities that relate to the coast take place within an implicit rather than explicit recognition of their coastal location. For example, a policy regarding industrial development may relate to a Council's entire administrative area, including the coast, but a coastal component to the policy will not actually be mentioned by name.

On the other side of the split are the District Council's of Moray and Banff and Buchan. These are the only two District Council's within the Moray Firth that produce their own Local Plans. In contrast to Highland Regional Council above, these two Council's actually

define a coastal zone within their administrative areas (see Figures 5 and 6) for which they produce specific policies with an explicit recognition of their coastal location.

Having said this however, a certain lack of specific interest in the coast seemed apparent when the Council's were asked to consider the importance of their coastal areas in a Regional / District wide context.

In Question A3, the Council's were asked to indicate what priority they gave to the coast solely, as a result, three counts of high priority and one of medium were recorded. However, in Question A4 the Council's were asked to consider the significance of the coast in a Regional / District wide context, by stating whether the coast was one of the five most important policy areas facing them. Here both Grampian Regional and Moray District Council's replied negatively to this question, and although Highland Regional Council answered positively, once again the term 'implicitly' was emphasised with regard to policy.

Therefore, this indicates that when Council's are asked to specifically consider their coastal areas, they classify them as important assets, however, when asked to consider them in a Regional / District wide context, coastal areas appear to decline in significance.

5.2.4.2. *Section B: The Administration of the Coast.*

B1. Are there any departments in your Authority whose interests do not extend to the coast ?

Yes / No.

If your answer is 'No', please go on to Question B2.

If your answer is 'Yes', can you specify these ?

All four Authorities answered negatively, indicating that all departments had at least a limited interest in the coastal zones of their administrative areas. Highland Regional Council again pointed out that, in their case, this was a result of the implicit recognition of the coastal location of the Council's policies and activities.[124]

B2. How many departments have responsibilities for various aspects of the coast ?

N°.....

Once again, Highland Regional Council pointed out that because of the way Council policies and activities in the coastal zone take place within an implicit recognition of their coastal location, it was impossible to single out specific departments with responsibilities for various aspects of the coast.[124] Of the remaining three authorities, both Grampian Regional and Moray District Council's indicated that four departments had responsibilities, while Banff and Buchan District Council listed three with responsibilities. The three were; the Planning, Leisure and Recreation, and Environmental Health Department's.[120]

B3. Are there any departments which have created a special division dealing specifically with the coast ?

Yes / No

If your answer is 'No', please go on to Question B4.

If your answer is 'Yes', can you specify these departments ?

Within the Moray Firth, none of the respondents had any special coastal divisions of any kind within their departmental structures. Having said this however, Highland Regional Council did indicate that a number of departments employ personnel with specific responsibilities within the coastal zone. For example, the Roads and Transport Department employ a Marine Superintendent and a number of Harbour Masters, an engineer with responsibilities for coastal protection and a diving unit.[124]

B4. How many committees have responsibilities which extend to various aspects of the coast ?

N°.....

This question was aimed at discovering whether the coast had had an influence on the organisation of Council members, that is, the committee structure of the Council's. However, Highland Regional Council failed to answer the question, and Banff and Buchan District Council was not asked this question in the shortened follow up questionnaire. Answers were forthcoming however from both Grampian Regional and Moray District Council's, with Grampian stating that it has five committees, including sub-committees, and Moray that it has four committees with responsibilities extending to various aspects of the coast.[123, 125]

B5. Are there any committees which have a special division / sub-committee dealing specifically with the coast ?

Yes / No.

If your answer is 'No', please go on to Question B6.

If your answer is 'Yes', can you list these ?

Grampian Regional Council was the only respondent authority that answered positively to this question, indicating that the Fishing Sub-Committee was involved in dealing with fisheries matters within the Councils coastal zone.[125]

B6. Are there any committees which are solely concerned with activities at the coast ? (e.g. Coast Protection Committees, Nature Conservation Committees, Recreation Committees etc)

Yes / No.

If your answer is 'No', please go on to Question B7.

If your answer is 'Yes', can you please list these ?

All respondents answered negatively with regard to this question.

B7. Has your Council delegated any of its functions relating to the coast to any other body ?

Yes / No.

If your answer is 'No', please go to Question B8.

If your answer is 'Yes', please specify ?

All respondents answered negatively with regard to this question.

B8. Are any of your Council's activities in the coastal zone the subject of joint committees / study groups, with any other body (whether formal or informal) ?

Yes / No.

If your answer is 'No', please go on to Question B9.

If your answer is 'Yes', can you give details ?

B9. Can you give an indication of other linkages your Council has established with parties interested in the coast ?

Yes / No.

If your answer is 'No', please go to Question B10.

If your answer is 'Yes', please give details ?

A degree of repetition was apparent in the answers to the above two questions, therefore, the responses have been combined in a composite response. All the respondents answered positively to the above two questions, and outlined specific details.

Grampian Regional Council stated that it was involved with; a coastal forum concerned with pollution which involved both Moray and Banff and Buchan District Council's, and consultations with Scottish Natural Heritage (SNH) regarding the Moray Firth Forum. The Council also stated that it works closely with non-statutory conservation bodies such as the Royal Society for the Protection of Birds (RSPB) and Marine Conservation Society.[125]
Highland Regional Council stated it was involved in the Cromarty Firth Liaison Group, which includes; the Cromarty Firth Port Authority, Scottish Natural Heritage (SNH), Highland River Purification Board (HRPB), Ross & Cromarty District Council and others. There is also co-operation with Grampian Regional Council with respect to erosion and deposition in the Moray Firth, as well as consultations with the Scottish Wildlife Trust, Scottish Natural Heritage (SNH) and others with regard to the organisation of the Future Firth Conference.[124]
Moray District Council has been involved in a large consultation process concerned with the development of a Draft Management Plan for Findhorn Bay Local Nature Reserve. A Steering Committee and advisory panel were set up, which included; Grampian Regional Council, Scottish Natural Heritage (SNH), the Royal Society for the Protection of Birds (RSPB), Highland River Purification Board (HRPB), Royal Findhorn Yacht Club, Findhorn Angling Club, and several others.[89] The District Council is also involved with Grampian Regional Council and Banff and Buchan District Council concerning environmental policies such as sewage sea outfalls.[123]

The Banff and Buchan Coastal Study (1986), outlines the linkages the Council set up in the establishment of Special Project Areas at the coast. Consultation and Steering Groups have been established, with the latter comprising representatives at officer level from; Banff and Buchan District Council, Grampian Regional Council, Banff and Buchan Tourist Board, North East River Purification Board (NERPB) and Scottish Natural Heritage (SNH).

The Consultative Group includes such organisations as Community Council's, Scottish Landowners Federation, Scottish Wildlife Trust, local interest groups and others.[122]

B10. Do you believe your Authority should become more involved in management functions within the coastal zone ?

Yes / No.

All respondents answered positively with regard to this question.

B11. Do you see the administration and management of the coast as inextricably linked with other Authority functions and other parts of your administrative area ?

Yes / No.

Please expand if possible.

The aim of this question was to provide an indication both of the degree of integration of the coast within the District / Region and an indication as to whether any substantive difference was perceived between the coast and other areas, the presence of which might, in instances, justify separate treatment of the coastal zone.

All the respondents stated that the coast was inextricably linked with other authority functions and other parts of their District / Region, providing a clear statement of either the intimate relationship between coast and hinterland, or a lack of perception of a difference between coastal and other environments.

5.2.4.2.1. Summary.

This section of the questionnaire suggested that the coastal zone is perceived as an integral part of the larger Regional / District administration of the Council's. The majority of departments interests implicitly extend to the coast, however, few departments / committees have specific responsibilities within the coastal zone. In contrast however, there is a considerable amount of involvement in joint committees / study groups with other bodies, which take the coast as their focus.

The coast does therefore function in many areas as an organising factor, specialist skills exist (see Question B3) and the exchange of information between authorities and statutory and non-statutory organisations occurs (see Questions B8 & B9). It can be said therefore

that the coastal zone, within the sphere of local government, emerges as something of a paradox, a part indistinguishable from the whole, yet possessing special requirements.[20]

5.2.4.3. *Section C: Ownership of the Coast.*

The third section of the questionnaire addressed the present ownership of the coast. No definition was proposed in terms of the depth of the coastal area to be admitted, and respondents were asked to address themselves to areas of land as opposed to individual buildings.

> C1. Are there any coastal areas (please consider not only land but foreshore / near shore islands / causeways / piers / offshore waters etc) in your administrative area which are in central government ownership ?
>
> Yes / No.
>
> If your answer is 'No', please go on to Question C2.
>
> If your answer is 'Yes', can you list these below and include if possible a plan / annotated tracing, showing the approximate extent and land use of any such areas ?

All respondents acknowledged areas of central government ownership within their administrative areas. Two main types of ownership predominated, Ministry of Defence (MoD) lands, and the holdings of the Crown Estate Commissioners (CEC).

Within the Moray Firth coastal zone the Ministry of Defence (MoD) owns a number of sites including; RAF Tain in Ross and Cromarty District, which is one of the most heavily used air weapons ranges in the UK, RAF Lossiemouth and Kinloss, which are both in Moray District, as well as a number of other installations dotted along the coastline (see Section 4.8).

The Crown Estate owns a large proportion of the foreshore and the seabed between the mean low water spring tide and the limit of territorial waters. Within the Moray Firth, Crown Estate holdings include; most of the coastline of east Caithness, stretches of the southern shore of the Dornoch Firth, stretches of the shores of the Cromarty, Inverness and Beauly Firths including Munlochy Bay, as well as large portions of the coastlines of Nairn, Moray and Banff and Buchan District's.[9]

C2. Are there any coastal areas (see C1) in your administrative areas which are owned by your Council ?

Yes / No.

If your answer is 'No', please go on to Question C3.

If your answer is 'Yes', can you please list these and include if possible a plan showing their approximate extent and land use (e.g. public open space, residential) ?

In Grampian Region the main areas of Regional Council ownership are the coastline's harbours. With the reorganisation of Scottish Local Government in 1975 Grampian Regional Council became Harbour Authority for ten harbours along the southern shore of the Moray Firth. These include the three general cargo and fishing ports of Buckie, Burghead and MacDuff, and also the seven smaller harbours of; Banff, Cullen, Findochty, Hopeman, Portknockie, Portsoy and Rosehearty, which are used mainly for recreational purposes these days. Each harbour is managed by a locally based Harbour Master, supported by Divisional Roads Office staff. The whole chain of harbours is administered by the Harbours and Coast Protection Section of the Department of Roads, based at Regional Headquarters in Aberdeen.

Other areas of Grampian Regional Council ownership were associated with amenity areas, highways and country parks and leisure areas.[125]

Highland Regional Council stated that there are areas of coastal land around the Moray Firth in Regional Council ownership, or leased from the Crown Estate and others. However, that these only comprise a very tiny proportion of the coastal zone, no matter how it is defined. Such land primarily relates to infrastructure provision, for example, sewage works, septic tanks, roads, car parks, amenity areas and park areas.[124]

Moray District Council also stated that it owned land at the coast, however, its function was markedly different than that owned by the Regional Councils. Land owned by the Council includes; Cullen golf course and caravan site, Lossiemouth golf course and caravan site and Burghead golf course and caravan site. Other areas of ownership include picnic sites, camp sites and promenades / pathways.[123] This emphasises not only the importance of recreational activity and demand in this area, but also the stress laid down by the Council on recreational provision.

Other areas of ownership appear insignificant next to this recreational dominance, although other areas owned include those for access, residential and harbour purposes.

C3. Can you list, and indicate if possible on a map, the other major ownership's and their usage in the coastal area ? (I would be particularly interested in National Trust holdings, major private land holdings, industrial estates, and Port Authority holdings).

Yes / No.

If your answer is 'No', please go on to Question C4.
If your answer is 'Yes', please list below.

All respondents provided details of other major land holdings within the coastal zone of the Moray Firth, although some ownership's such as estates were mentioned by title only, with no indication as to whether the land was used for instance for agriculture, industrial or development purposes.

The uses, when ever specified, were diverse, embracing land owned by voluntary organisations, educational establishments, the Church, members of the general public (e.g. homes), the holiday industry, industry (e.g. engineering, petrochemicals, estates, docks etc), transport industry and agricultural concerns.

C4. Does your Authority see a need for increased public ownership at the coast ?

Yes / No.

If your answer is 'No', please go on to Question C5.
If your answer is 'Yes', can you please expand ?

Both Highland Regional and Moray District Council's saw a need for increased public ownership at the coast, while Grampian Regional Council saw no need.

Highland Regional Council stated that it has argued for increased public scrutiny of development and change in the coastal area rather than increased public ownership. However, it was further stated that the Council does have an interest in acquiring land where this is related to the realisation of projects it wishes to undertake, but again, such acquisitions tended to be very limited in extent.[124]

Moray District Council stated that it saw increased public ownership at the coast as an opportunity for the coastal zone to be held in trust, in order to provide further opportunities

and increased public access at the coast, especially to the foreshore.[123] This attitude reinforces the existing focus of District Council ownership expressed in Question C2.

C5. Are there any areas of coast your Council would like to acquire ?

Yes / No.

If your answer is 'No', please go on to Question D1.

If your answer is 'Yes', can you please list these areas and state why you would like to acquire them (e.g. nature conservation purposes).

Paradoxically, none of the respondents answered positively to the above question, though for Grampian Regional Council this was not so surprising considering its answer to the previous question. No reasons were give as to why both Highland Regional and Moray District Council's had answered negatively to this question but positively to the proceeding one. One possible answer could be that of a financial constraint upon the activities of these Council's.

5.2.4.3.1. Summary.

The general picture with respect to coastal land that can be derived from this section is that there is a fairly sizeable amount of public ownership at the coast. At central government level, the use of this land falls mainly to Crown and defence considerations, while at the regional level, the main consideration is the provision of infrastructure such as; harbours, roads, sewage works, amenity areas and access. In contrast, at district level it appears that it is the provision of recreational areas and opportunities that dominates the widely occurring ownership.

5.2.4.4. *Section D: Existing Policies and Management.*

Having built up a generalised picture of the prevailing administrative arrangements and ownership patterns at the coast within the Moray Firth, the questionnaire then addressed the topic of existing policy directives and management initiatives.

D1. Are there any coastal areas in your administrative areas which are the subject of protective designations ?

Yes / No.

If your answer is 'No', please go on to Question D2.

If your answer is 'Yes', can you list these and indicate the designating authority ?

The first question focused on the incidence of protective designations around the Moray Firth coastline. All the respondents stated that they had protected coastal areas within their District / Region. A range of designations were specified including; Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), National Scenic Areas (NSAs), Local Nature Reserves (LNRs), as well as proposed Local Nature Reserves. There are also non-statutory protected areas within the Moray Firth coastal zone run by the Royal Society for the Protection of Birds (RSPB) and the Scottish Wildlife Trust. The exact positioning of these protected areas can be seen on Map 10, Section 4.11.

Of all the types of protection designations mentioned above however, none are specifically coastal in trajectory and therefore it could be argued that the degree of protection afforded the coastal zone might be incidental to a wider concern for the conservation of nature and landscape in general. However, as stated by Halliday (1986), such a conclusion would be to deny the important role played by the coastal heritage in determining these designations, and the fact that many of the protective designations are products of a wider conservation movement does not imply therefore that the special needs of the coast are being neglected as far as conservation is concerned.[20]

D2. Are there any examples of conditions at the coast which are the subject of local bye-laws (e.g. parking on beaches, speed of vessels, public access, public behaviour etc) ?

Yes / No.

If your answer is 'No', please go on to Question D3.

If your answer is 'Yes', please specify.

A second type of control addressed was the use of local bye-laws to mediate coastal activity. Both Highland Regional and Moray District Council's answered positively, however, Grampian Regional Council stated that there were no such examples within its administrative area.

Highland Regional Council stated that often within harbour areas where the Council is Harbour Authority, bye-laws do occur, however, Highland Regional Council has no Harbour Authority powers within the Moray Firth.[124]

Moray District Council stated that it was considering bye-laws concerning its proposed Local Nature Reserve at Findhorn Bay.[123] If designated, bye-laws would probably be

introduced that would restrict vehicle access, the removal of shingle, the lighting of fires and the commercial digging of bait.[89]

D3. Does your Council provide any special coastal service (e.g. lifeguards, beach chalets etc) ?

Yes / No.

If your answer is 'No', please go on to Question D4.
If your answer is 'Yes', please specify.

A further area where a particular coastal dimension was anticipated was in the provision of services peculiar to the coast, such as the employment of lifeguards or the ownership of beach huts / chalets. However, all respondents answered negatively regarding this question.

D4. Does your Council provide any educational or information services based on the coastal zone (e.g. field centres, ranger / warden services, tourist information offices, classes in local schools etc) ?

Yes / No.

If your answer is 'No', please go on to Question D5.
If your answer is 'Yes', please give details.

Surprisingly, none of the respondents stated that they provided any type of field centres or tourist information offices with regard to their coastal areas. However, Moray District Council did state that it was planning to employ a Local Nature Reserve ranger after the designation of its Findhorn Bay site.[123]

Both Highland and Grampian Regional Council's stated that their local school curriculum's had a coastal emphasis. Highland Regional Council also stated that the Countryside Section of the Leisure and Libraries Department, and the Countryside Officer in the Planning Department provide a coastal element in education and information services.[124]

D5. Does your Council actively market the coastal zone and any of it attractions / facilities ?

Yes / No.

If your answer is 'No', please go on to Question D6.
If your answer is 'Yes', please specify and give the departments concerned.

This question was again seen as a measure of coastal awareness on the part of local government. All respondents stated that they marketed, or planned to market, some aspect of their coast.

Grampian Regional Council stated that the coastline of the Moray Firth was marketed via general promotional literature relating to the region, as well as in specific tourist information literature.[125]

In contrast to this Highland Regional Council made no mention of marketing the tourist potential of its coastal zone. Instead it stated that it concentrated on marketing the trade / industrial potential of its coastline, especially harbour and fish landing facilities.[124]

Moray District Council stated that it would begin marketing the tourist potential of the proposed Findhorn Bay Local Nature Reserve once it had been designated.[123]

D6. Is any of your coastal area covered by management agreements of any kind (e.g. traffic management, land use management, zoning policy (either by time or space)) ?

Yes / No.

If your answer is 'No', please go on to Question D7.

If your answer is 'Yes', please give details.

6.1 Do any of these management agreements extend over any part of the sea ?

Yes / No.

If your answer is 'Yes', can you indicate this by adding the letter 'S' to the appropriate listing above in D6 ?

The concept of management is multifaceted, many of the dimensions already covered by the questionnaire; provision of services, bye-laws and departmental responsibility, are aspects of management at the coast. One area that has however been receiving particular attention in recent times is the management agreement. Authorities were therefore asked whether any of their coastal area was covered by management agreements and whether any of these agreements encompassed a part of the sea.

Banff and Buchan District Council pointed out that its 1993 Local Plan 3 contains General Policy Proposal D/ENV5 on the Promotion of Management Agreements.[120] This states that –"the District Council will encourage and, where appropriate, enter into Management Agreements to safeguard areas of natural, scientific or amenity value."

The 1986 Coastal Study outlines the development of Special Project Areas along its coastline, in conjunction with other agencies and groups (see Questions B8 & B9). Four types of Special Project Areas occur at a number of locations along the coastline, these are:

- Special Project Areas primarily for recreation and tourist activity but with significant conservation considerations, these occur at:

  a) Aberdour Bay Area.

  b) Banff to Cullen coastline.
- Special Project Areas with primarily conservation related objectives but also having significant implications for recreation and tourism, these occur at:

  c) Portsoy Links / East and West Heads.

  d) Cullykhan Bay Area and the Tore of Troup.
- Special Project Areas requiring action associated with environmental enhancement and having major recreational considerations, these occur at:

  e) Tarlair Pool Area east of MacDuff.

  f) Fraserburgh Bay Area.

  g) Banff Links.
- Special Project Areas with primarily environmental improvement and enhancement objectives, these occur at:

  h) Areas where dumping occurs at the coast.

  i) Fraserburgh to Rosehearty coast.[122]

Moray District Council gave details regarding possible future management agreements concerning the proposed Local Nature Reserve at Findhorn Bay. Local Nature Reserve status would allow for the possible introduction of bye-laws and future management agreements if the future management team deemed them necessary and, given the circumstances, an effective method of control.[89] The activities for which future management is being considered are outlined in the Council's response to Question E1.

Moray District Council was the only respondent with agreements encompassing the sea, that is, the marine environment within Findhorn Bay.

Highland Regional Council stated that it operates 'Management Rules' under the Local Government (Scotland) Act 1989 on coastal land it owns or manages. Bonar Bridge was cited as a example of an area where such rules applied, however, no details of the rules were provided.[124]

Grampian Regional Council answered negatively to this question.[125]

D7. Does your Council act as a Port or Harbour Authority ?

Yes / No.

D8. Does your Council have any other statutory involvement with Port or Harbour functions (e.g. Port Health) ?

Yes / No.

If your answer is 'No', please go on to Question D9.

If your answer is 'Yes', please specify.

This is an important area of enquiry because it is one of the areas where local government jurisdiction may already extend beyond the low water mark.

As stated earlier in Question C2 Grampian Regional Council acts as Harbour Authority for ten harbours along the southern shore of the Moray Firth, including those present along Moray and Banff and Buchan District Council's coastline. Highland Regional Council also has Harbour Authority responsibilities, but not within the Moray Firth.

D9. Are there any authorities / agencies with powers in your administrative areas who manage the sea ?

Yes / No.

If your answer is 'No', please go on to Question E1.

If your answer is 'Yes', can you specify which authorities ?

Both Grampian and Highland Regional Council's stated that Port and Harbour Authorities had management powers within their administrative areas.

In Highland Region the major Port Authority is the Cromarty Firth Port Authority which was set up by the Cromarty Firth Port Authority Order Confirmation Act 1973. Jurisdiction of the Authority extends approximately 2.5 miles offshore. Also within the Highland Region, Inverness harbour is owned and operated as a Harbour Trust established by an Act of Parliament in 1847. Wick harbour is also a Harbour Trust.

Harbours not controlled by Grampian Regional Council within its administrative area are; Fraserburgh which is run by a Harbour Authority, Lossiemouth, Whitehills, Gardenstown, Findhorn, Portgordon, Pennan and Sandhaven harbours.[9]

Within Moray and Banff and Buchan District Council's administrative areas Grampian Regional Council acts as Harbour Authority for ten harbours (see Question C2).

A government department that has management powers is the Ministry of Defence (MoD). Traditionally the military has had absolute supremacy over the area they use,[126] and as a result also have management powers. Within the Moray Firth, one area of sea where such management powers apply is the RAF bombing range in the sea off Rosehearty.[125]

Highland Regional Council also pointed out that a large number of agencies have duties and responsibilities within the marine environment, but do not however 'manage' it. (see Sections 5.6 to 5.15).[124]

5.2.4.4.1. Summary.

The general impression gained from this section of the questionnaire was that, in practice, the coast had created an additional dimension to many of the Regional / District Council's activities. For example, evidence was gained of involvement in conservation at the coast, port and harbour responsibilities, limited bye-law provision, limited provision of information and marketing activities, as well as involvement in the establishment of management agreements at the coast.

5.2.4.5. *Section E: The Planning of the Coast.*

This section of the questionnaire was aimed at the Planning Departments of the constituent authorities and aimed to assess current planning practice at the coast, particularly in terms of the amount and type of plan coverage, the extent of the data base on coastal conditions, areas where existing powers had been found inadequate and where changes could be suggested relative to either planning or management.

E1. Does your Council have any plans which relate to the coast ?

Yes / No.

If your answer is 'No', please go on to Question E2.

If your answer is 'Yes', can you list these and indicate whether they are (a) statutory, or (b) non-statutory ?

As to be expected both Highland and Grampian Regional Council's stated that they produce statutory Structure Plans for the Moray Firth which implicitly incorporate the coast. As outlined previously, once Structure Plans have been produced, Local Plans can then be formulated. The preparation of Local Plans aims to identify those areas where the general statements given in Structure Plans are inadequate alone and require more detailed local interpretation.[20]

Of the respondents, Moray and Banff and Buchan District Council's, as well as Highland Regional Council, acting as General Planning Authority for the coastal districts of Nairn, Inverness, Ross and Cromarty, Sutherland and Caithness,[117] all stated that they produce statutory Local Plans that, to varying degrees, have a coastal component (see Question E2).

All four respondents also produce non-statutory plans which relate in varying degrees to the coastal area within their administrative areas as a whole. Banff and Buchan District Council produced its Coastal Study (1986), Moray District Council its Findhorn Bay Local Nature Reserve Draft Management Plan, Grampian Regional Council has produced an Environmental Charter and Action Plan, while Highland Regional Council has produced Fish Farm Framework Plans, however, at present these do not apply to the Moray Firth.

Halliday (1986), suggested that for plans to be of any real value they must cut across the conventional pattern of land use planning and concentrate on use and management of activity. A move towards such thinking can be seen to some extent in the above mentioned non-statutory plans, especially Moray District Council's Findhorn Bay Local Nature Reserve Draft Management Plan. Within this plan, the present day occurrence and future management of such activities as; agriculture, drainage, habitat management, coastal protection / erosion, water based activities, wildfowling, fisheries, effluent discharge, education / interpretation, research, access / visitors, horses / dogs, general recreation, fire

lighting, turf cutting and dumping / litter have been assessed with regard to the conservation of the Bay.[89]

E2. Does your Council have any specific development control guidelines covering the future use of the coast in your administrative area ?

Yes / No.

If your answer is 'No', please go on to Question E3.

If your answer is 'Yes', can you specify these ?

Specific development control guidelines covering the use of the coast were also investigated, as these, together with the aforementioned plans describe the essential framework of 'local' control. As such guidelines are a feature of 'local' control, both Grampian and Highland Regional Council's answered negatively to this question. However, Highland Regional Council, in its capacity as General Planning Authority for the coastal District's of Nairn, Inverness, Ross and Cromarty, Sutherland and Caithness[117] stated that specific guidelines were present in the Local Plans it has produced.[124]

For example, the 1992 Inverness, Culloden and Ardersier Local Plan contains GP (General Policy) 2.5.10. on Coastal Conservation. This policy states that –"there will be a general presumption against development on the seaward flanks of public roads which is not essential to the working of the land concerned, in the interests of general amenity, recreational pursuits such as bird-watching and traffic safety."[112]

Similar Coastal Conservation policies are present in; the 1988 Beauly and District Local Plan, 1987 East Caithness Local Plan, 1992 Easter Ross Local Plan and the 1994 Black Isle Local Plan Final Draft.

Of the remaining Local Plans, that is; Helmsdale and Brora 1983, Golspie and Lairg 1983 and Nairn 1983, these rely on the implicit coverage the coast receives in the Highland Regional Council Structure Plan for their policy towards the coast.

Moray District Council was very forthcoming, providing the modified statement of its 1993-1998 District Local Plan regarding the coastline, General Policy ENV8 on Coastal Protection Zones. This stated that –"the Council will protect the areas of the coastline

between settlements by designating a Coastal Protection Zone within which development will not be permitted except:

- where there is an existing use, an extension or reuse which does not prejudice the principle of the Coastal Protection Zone; or
- for low intensity recreational or tourist use; or
- for uses directly related to agriculture, forestry and fishing."[127]

Banff and Buchan District Council provided an extract from its District Local Plan 3, 1993. With regard to the coast, this stated that –"implementation of the findings of the Coastal Study (1986), has continued since the last Local Plan was adopted. It is intended that the continuing programme of works and development control criteria established by the Study be carried through into this Plan."[128]

To this end the 1993 Plan contains Control Policy D/ENV20 on Coastal Development. This states that –"in considering proposals for development at the coast and outwith the towns and villages, existing or potential recreational use and the environmental quality of the area shall be taken into account in accordance with the following criteria:

- No Development: No development will be permitted due to high amenity and / or high rating of scientific or heritage value.
- Limited Development: Where limited development is possible within environmental constraints in the form of improved car parking provision and access etc, to allow a greater number of people to enjoy the area.
- Development Opportunities: Where recreational and tourist developments are encouraged in association with a Tourist Development Initiative (Policy D/EC16) or Special Project Area (Policy D/ENV21)."

To secure the implementation of the above policy, a series of Special Project Areas have been established under Policy D/ENV21 Identification of Special Project Areas. This policy states that –"the District Council has identified Special Project Areas at the coast, and in consultation with other agencies and local community groups, will promote

environmental management and recreational and other improvement programmes for subsequent implementation" (see Question D6).[128]

E3. Has your Council conducted any special studies / surveys into conditions at the coast (e.g. landscape quality, recreational possibilities) ?

Yes / No.

If your answer is 'No', please go on to Question E4.

If your answer is 'Yes', can you list these below ?

Grampian Regional Council stated that it had not carried out any such studies or surveys, while Highland Regional Council replied that it had, but not within the Moray Firth.

In contrast to the two Regional Council's, both Moray and Banff and Buchan District Council's have carried out studies / surveys. Moray District Council stated that it had carried out landscape, environmental quality and user group studies related to its proposed Local Nature Reserve at Findhorn Bay, as well as studies and surveys in order to produce their Moray District Local Plan Proposals Map-North,[123] while Banff and Buchan District Council produced its Coastal Study in 1986.

E4. Have you experienced any problems at the coast where existing planning powers were not sufficient to control proposed changes to the environment ?

Yes / No.

If your answer is 'No', please go on to Question E5.

If your answer is 'Yes', can you give details ?

Grampian Regional Council did not answer this question, however, both Highland Regional and Moray District Council's stated that they had experience of coastal problems outside the scope of their planning control. For both Council's these problems concerned the Crown Estates' exemption from normal planning procedures. Moray District Council did not expand any further, but Highland Regional Council stated that the positioning of fish farms was their main concern.[123, 124]

E5. In planning the coast are there any areas where your Council feels joint administration with other bodies is necessary ?

Yes / No.

If your answer is 'No', please go on to Question E6.

If your answer is 'Yes', can you give details ?

All the respondents felt a need, in instances, for joint administration at the coast.

Highland Regional Council stated that it was committed to the development of coastal zone management, seeing it as a rational way forward in addressing the planning and management needs of coastal land and water. The Council is seeking to progress the coastal zone management approach through the initial step of a pilot study for Skye and the adjacent mainland. At the strategic regional level it is hoped that discussions between regionally effective regulatory and funding agencies, that is; Highland Regional Council itself, Highland River Purification Board, North West Region Scottish Natural Heritage, the Scottish Office Departments of Agriculture and Fisheries, Transport, and Trade and Industry, the Crown Estate and Highland and Islands Enterprise can make progress in setting out an agreed framework of coastal zone management principles.

It is also vital to coastal zone management that the users of the coastal resource are fully involved in the management process. In seeking to involve players at all levels of organisation, it is envisaged that the strategic policy making process will be conducted in the public domain through consultation on intermediate and final draft strategy documents. Such strategy documents would set an explicit framework for the activities of the various sectors and recommend ways forward for ensuring optimum levels of local management and co-ordination.

Specifically within the Moray Firth, the Cromarty Firth Liaison Group is a further example of the types of mechanism which can contribute to the coastal zone management process. The Group was initiated under the auspices of the Cromarty Firth Port Authority. It is now chaired by the Director of Planning for Highland Region and has recently extended to include a broad forum of interests involved in the use and management of the Cromarty

Firth for which it is currently examining the prospects for drawing up a management plan.[124]

Among the other respondents, the statutory conservation body Scottish Natural Heritage (SNH) emerged as the main agency with whom joint administration for planning purposes with regard to conservation, was felt necessary.

E6. Does your Council think any reforms are necessary in local government to:
(a) the planning of the coast ? Yes / No.
(b) the management of the coast ? Yes / No.
If your answer is 'Yes' to either (a) or (b) can you give details ?

Moray District Council did not respond to this question, however, both Grampian and Highland Regional Council's stated that reforms in local government relative to both planning and management at the coast were necessary.

Specifically, Grampian Regional Council stated that there was a need for more specific policies which related directly to the coast for both planning and management, as well as more interaction with other bodies and authorities for management.[125]

Highland Regional Council stated that the reform it was committed to was the development of coastal zone management, and the actions and associations required to achieve this (see Question E5).[124]

E7. Does your Council think that existing powers are used to sufficient effect in managing the coastal zone ?
Yes / No.
If your answer is 'Yes', please go on to Question F1.
If your answer is 'No', can you give examples of powers which could be used more widely (and any difficulties in using them) ?

A mix of responses were received to this question, Grampian Regional Council stated that existing powers were sufficient,[125] while Moray District Council stated that they were not, but gave no further details.[123]

From this response and previous responses, Moray District Council can be placed into a category outlined by Halliday (1986) in which authorities which are already active at the coast feel further progress could be made.

Highland Regional Council's reply was 'probably not', but that the concept was in need of further study and collaboration on behalf of the agencies involved.[124]

5.2.4.5.1. Summary.

This section of the questionnaire indicated a similar split as outlined in the first section, however, this time with regard to planning at the coast in terms of both Local Plan coverage and specific development control guidance.

Once again it is the District Council's of Moray and Banff and Buchan that are taking the lead, with both Council's having developed specific detailed development control policies for the coast (see Question E2).

In contrast three of the Local Plans produced by Highland Regional Council for the Moray Firth had no development control policies for the coast, while the remaining five were equipped with rather limited development control policies when compared to those of Moray and Banff and Buchan District Council's (see Question E2). However, one encouraging response was the commitment expressed by Highland Regional Council to the process of coastal zone management.

Some problems were encountered which lie beyond existing planning powers, however these are of limited occurrence and therefore are perhaps amenable to solution at the local rather than the national level.

Halliday (1986) stated that a lack of desire for change at the national level had been borne out by her replies to the questions gauging attitude towards reform in planning and management, and the use of existing powers. In contrast, within the Moray Firth both Regional Council's indicated a need for reforms, while Highland Regional Council and Moray District Council both stated that existing powers were probably not used to sufficient effect in managing the coastal zone.

5.2.4.6. *Section F: Problems and Conflicts in the Coastal Zone.*

The final section of the questionnaire addressed the problems and conflicts in the coastal zone, as perceived by local government. Problems and conflicts of specific users of the Moray Firth are identified in Chapter 6.

F1. Can you give the approximate % for the land at the coast in your administrative area which would fall into the following categories ?

(a) Industrial / Commercial Districts: Areas with intensive uses of heavy industry and commercial character. .....%.

(b) Urban Districts: Areas with intensive uses of an urban character. .....%.

(c) Residential Districts: Areas of medium intensity housing. .....%.

(d) Commercial / Residential Districts: Medium to low intensity commercial and recreational areas and facilities. .....%.

(e) General Purpose Districts: Areas with medium intensity uses of a general rural character. .....%.

(f) Agricultural / Forestry District: Areas with low intensity uses that are resource oriented. .....%.

(g) Resource Protection Districts or Natural Areas: Consists of those areas that if developed are likely to be unsatisfactory in terms of adverse environmental effects (e.g. wetlands, estuaries, flood plains etc). .....%.

(h) Others (please specify). .....%.

This question was designed to give a general picture of coastal land use within the Moray Firth, and was included in the questionnaire as an aid to any future zoning policy ideas (see Chapter 9). However, both Grampian and Highland Regional, and Banff and Buchan District Council's stated that such information was not readily available.

Moray District Council gave detailed answers to all parts of this question, these were as follows; Districts (a) 0%, Districts (b) 4%, Districts (c) 3%, Districts (d) 5%, Districts (e) 0%, Districts (f) 80%, Districts (g) 5% and Districts (h) were outlined as the two RAF airfields at Lossiemouth and Kinloss.[123]

F2. Are there any particular problems your Council has had to contend with, or conflicts it has encountered in its coastal area ?

Yes / No.

If your answer is 'No', please go on to Question F3.

If your answer is 'Yes', please can you list these and detail possible solutions ?

Once again, a range of replies was received concerning this question. Grampian Regional Council stated that it had had no conflicts or problems to contend with,[125] while Moray District Council stated that its main problem was one of pollution emanating from sewage outfalls and the unsightly effect this has on the amenity value of its coast.[123]

Highland Regional Council on the other hand, replied that its problems in the coastal zone centred around the encouragement of a strong economy and improved community facilities and the impact these have or might have on the natural environment.[124]

None of the respondents proposed any possible solutions to their problems. However, from previous answers, it can be assumed that Highland Regional Council believes that coastal zone management is the way forward to solving its problems in the coastal zone.

F3. Are there any marine activities which have an impact at the coast in your administrative area ?

Yes / No.

If your answer is 'No', please go on to Question F4.

If your answer is 'Yes', can you list these ?

F4. Do you envisage marine developments in the future affecting your administrative area

Yes / No.

If your answer is 'No', please go on to Question F5.

If your answer is 'Yes', please specify.

The next two questions attempted to focus local government attention on inshore waters, moving towards an embracing definition of coastal matters. The response countered the view often taken that District / Regional authorities perception is limited to land based activities.

All respondents answered positively with regard to both questions. The main marine activities regarded as having an impact on the coastal zone of the Moray Firth were; the oil and gas industry, marine transport (including oil), the fishing industry, recreational developments, aquaculture developments, marine survey and dredging (small scale).

Marine developments envisaged in the future as having an impact on the coastal zone of the Moray Firth were; further development of the oil and gas industry (both onshore and offshore), a changing fishing industry, increased demand for aquaculture sites and especially, increased recreational use of both a land based and water based nature (see Section 4.6).

F5. Does your Council:

(a) have any contingency plans for coastal disasters such as oil pollution, sea level rise, storm damage, stranded vessels etc ?

Yes / No.

If your answer is 'No', please go on to Question F5b.

If your answer is 'Yes', please give details.

(b) contribute to the contingency plans of other organisations ?

Yes / No.

If your answer is 'No', please go on to Question F6.

If your answer is 'Yes', please give details (including the organisation with overall responsibility for the contingency plan).

Both Grampian and Highland Council's replied that they have oil pollution contingency plans developed in co-operation with other organisations such as, Highland and North East River Purification Board's, Cromarty Firth Port Authority and others.[124, 125]

Moray and Banff and Buchan District Council's stated that they had a general District Emergency Plan, but relied on Grampian Regional Council's oil pollution contingency plan to protect their coastline from oil spills.

F6. Has your Council any other comments to make about coastal zone management, present or future ?

At local government level within the Moray Firth, Highland Regional Council is the only authority with planning and development control that has committed itself to the concept of coastal zone management. This commitment is outlined in the Council's answer to Question E5. The other respondents gave no reply to this question.

5.2.4.6.1. Summary.

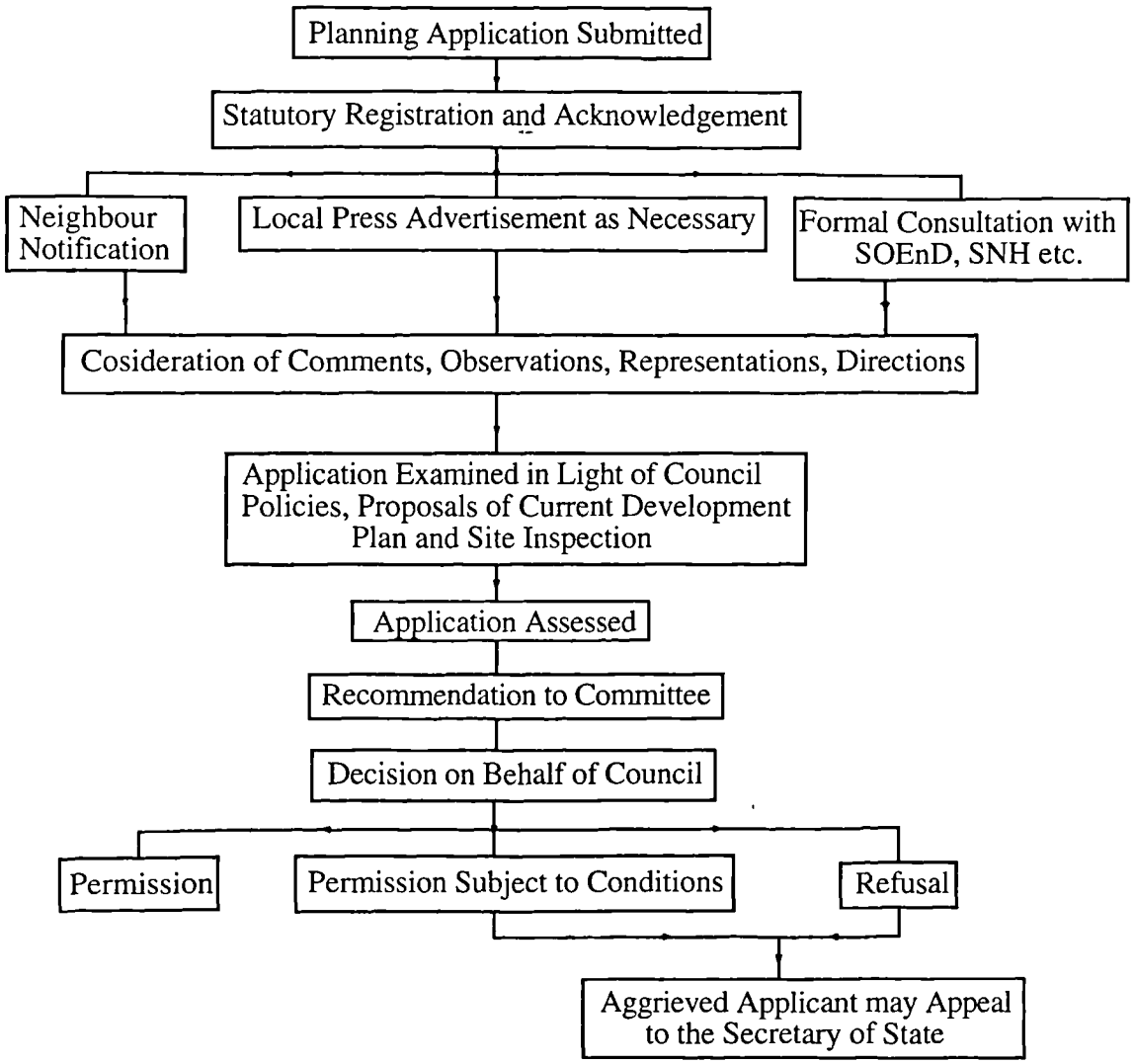
This section of the questionnaire has pointed out that there are a number of conflicts and activities which impinge on the coastal zone, and that these conflicts and activities are likely to increase in the future.

5.2.5. Development Control.

Planning authorities Structure and Local Plans form very much the first phase of the actual town and country planning system. The second phase is the development control system which is outlined over the page in Figure 7.

Prior to any development taking place a developer is first required to apply for planning permission to the relevant planning authority. In the case of the Moray Firth, this would either be Moray or Banff and Buchan District Council's, or if the development was to be located within Caithness, Sutherland, Ross and Cromarty, Inverness or Nairn District's, it would be Highland Regional Council.

Figure 7: Processing a Planning Application.[119]



5.3. *Strategic Planning.*

As already mentioned, General and District Planning Authorities deal with planning and management matters of regional and local importance. Matters which are of a strategic importance are dealt with at national level by the issuing of National Planning Guidelines.

These were introduced in the early 1970's, revised in 1981 and have been added to since. They identify issues of national importance and the appropriate planning procedures that should be adopted. As a result, therefore, there is an obligation on planning authorities that Local Plans must relate the strategic considerations of the governments National Planning Guidelines to local circumstances.

The most important National Planning Guidelines to date relating to the coastal zone in Scotland are the Coastal Planning Guidelines for North Sea Oil. However, the Scottish Office Environment Department (SOEnD) is at the moment working on a draft response to the report of the House of Commons Environment Committee on Coastal Zone Protection and Planning entitled 'Scotland's Coast'.

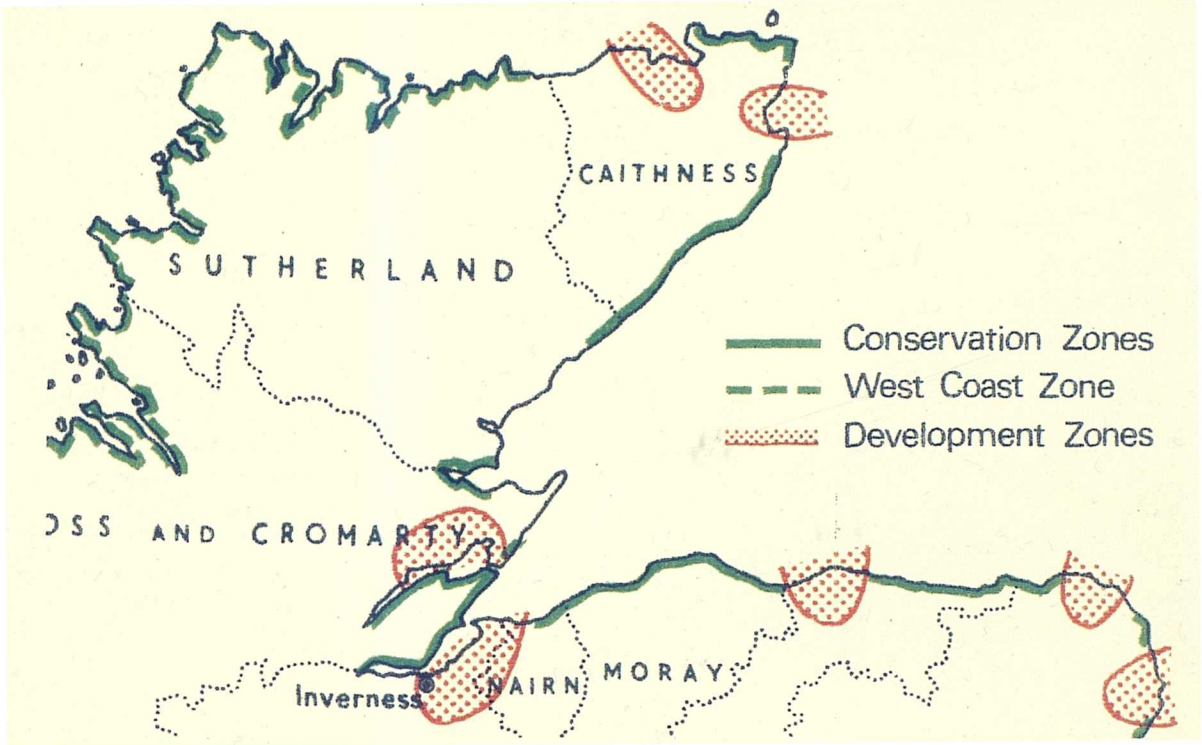
5.3.1. Coastal Planning Guidelines: North Sea Oil.

As already stated, Structure and Local Plans must take account of the National Planning Guidelines. An example of this are the guidelines relating to shore based North Sea oil and gas developments in Scotland, issued in 1974 and restated in 1981.

Within the Moray Firth five coastal zones (see Figure 8) were suggested in which development might in principle be acceptable and within which developers were encouraged to look for sites in the first instance. These zones were referred to as Preferred Development Zones and are as follows; Fraserburgh, Buckie, Inverness and Cromarty Firths and the Wick area.

Between the above five Preferred Development Zones, areas of coast of particular national scenic, environmental or ecological importance were suggested in which major new oil and gas related developments would in general be inappropriate, and could thus be justified only in exceptional circumstances (see Figure 8). These were referred to as Preferred Conservation Zones and include; Rosehearty to Portknockie, Portgordon to the Inverness District boundary, the Black Isle, the North Sutor, Tarbat Ness to Dornoch, Helmsdale to South Head and the area around Duncansby Head.[129]

Figure 8 : North Sea Oil Coastal Planning Framework.[129]



5.3.2 Scotland's Coast.

As mentioned previously, 'Scotland's Coast', once completed is intended as a response to the report of the House of Commons Environment Committee on Coastal Zone Protection and Planning. Although this report concentrated on the English and Welsh coastlines, the government's published response stated that the Select Committee's conclusions had –"a nation-wide relevance which should be addressed according to the circumstances of different parts of the UK."

The broad aim of the guidance will be to promote the sustainable and sensitive use of Scotland's coast, taking account of the diversity of the coast and the wide range of interests within it.[130]

5.4. *Other Agencies Involved in Planning and Management above the Low Water Mark.*

5.4.1. The Commissioner for Local Administration in Scotland.

The Commissioner for Local Administration in Scotland (the Ombudsman), investigates complaints of maladministration raised by members of the public.

5.4.2. Scottish Office Inquiry Reporters Unit.

A previously stated, this unit is responsible for the administration of Public Local Inquiries. In most cases, appeal decisions are taken by the Reporter, however, the Secretary of State for Scotland takes the decisions on major or controversial cases. Reporters also chair Structure Plan Examinations in Public (EIP) and present reports to planning authorities on Local Plan Inquiries.

5.4.3. Scottish Office Environment Department (SOEnD).

This department is concerned with environmental conditions and provisions, mainly by local authorities and other agencies, of the main infrastructure services. Its responsibilities cover policy and functions affecting physical development in Scotland including; town and country planning, urban renewal, housing, roads, water supply and sewerage, building control and conservation etc.

5.4.4. Trade and Industry Department for Scotland.

This department advises the Secretary of State on matters relating to industrial and economic development in Scotland, including Scottish aspects of regional policies both in UK and EC contexts.

5.4.5. Health and Safety Executive (HSE).

Advises the planning authorities and the Secretary of State on Health and Safety matters raised by hazardous developments.

5.4.6. Lands Tribunal for Scotland.

The tribunal determines questions of disputed compensation, processes applications to vary or discharge land obligations and provides jurisdiction on purchase and blight notices.

5.4.7. Historic Buildings Council for Scotland.

This is an advisory body set up under the Historic Buildings and Ancient Monuments Act 1953 to advise the government on loans and grants for the repair and maintenance of historic buildings and the enhancement of conservation areas, and on other functions carried out under the planning acts, for example, the listing of buildings.

5.4.8. Scottish Natural Heritage (SNH).

Scottish Natural Heritage (SNH) was formed as a result of the Natural Heritage (Scotland) Act 1991 which brought together from April the 1st 1992 the Countryside Commission for Scotland and the Nature Conservancy Council for Scotland (NCCS). It advises planning authorities and the Secretary of State on matters relating to the protection of fauna, flora, and physiographic features.

Above the low water mark, this is primarily achieved through the establishment of such national statutory designations as; Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs) and National Scenic Areas (NSAs), as well as the new Special Areas for Conservation (SACs) designated under the EC Habitats Directive.

Nature and landscape conservation designations present within the coastal zone of the Moray Firth are illustrated on Map 10, Section 4.11.

The Joint Nature Conservation Committee (JNCC) is the co-ordinating body for Scottish Natural Heritage (SNH), English Nature and the Countryside Council for Wales. It has a remit for national and international matters concerning nature conservation.

5.5. *Development above the Low Water Mark outside Planning Control.*

5.5.1. Port and Harbour Authorities.

Permission is required under the Town and Country Planning (Scotland) Act 1972 for the construction of port and harbour works, however, development is in some cases permitted by virtue of the Town and Country Planning General Development Procedural Order 1992.

Under the Town and Country Planning General Development Procedural Order 1992, certain development by port and harbour authorities and their lessees is permitted without the permission of the local planning authority or the Secretary of State.

This authorised development is specified in Class B of Part 17 of Schedule 2 to the 1992 Order and consists, subject to certain exceptions and qualifications, of development by a port or harbour authority, or their lessees, of an authority's operational land for the purpose of shipping or in connection with the embarking, disembarking, loading, discharging or

transportation of passengers, livestock or goods at harbour. The Town and Country Planning Act defines 'operational land' in relation to statutory undertakers, which include port and harbour authorities, as –"(a) land which is used for the purpose of carrying on their undertakings; and (b) land in which an interest is held for that purpose, not being land which, in respect of its nature and situation is comparable rather with land in general than with land which is used, or in which interests are held, for the purpose of the carrying on of statutory undertakings." The Act then specifies the certain circumstances in which land of statutory undertakers is to be treated as not being operational land.[131]

Another class of development authorised by the General Development Procedural Order 1992, which is relevant in relation to port and harbour authorities is that specified in Class A of Part 11 of Schedule 2 of the Order. This consists, subject to certain qualifications, of development authorised (i) by any local or private Act of Parliament or (ii) by any order approved by both Houses of Parliament or (iii) by any order made under Section 14 or Section 16 of the Harbours Act 1964, that is, harbour revision and empowerment orders, which designates specifically both the nature of the authorised development and the land upon which it may be carried out.[131]

Under Article 4 of the General Development Procedural Order, the Secretary of State for Scotland or a local planning authority, subject in most cases to the Secretary of State's approval, may give directions restricting development permitted under the Order. Such restricted development, and other development which is not permitted under the Order will require planning permission in the usual way. However, where the port or harbour authority is also a planning authority (e.g. Grampian Regional Council) it will be able to deem itself planning permission for development.[132]

The Marine Environment.

The proceeding information has provided an insight into the planning and management regime operating on the landward side of the low water mark. What follows is a similar investigation concerned with the management regime operating below the low water mark.

As stated previously, the town and country planning system is possible on land because land is capable of being divided into discrete packets in identifiable ownership. Below the low water mark different areas may be more or less subject to particular uses, but division along rigid boundaries is impractical. The Crown Estate Commissioners are the landlords of the seabed, but the sea itself is owned by no one. Therefore, as is described below, management and regulation systems have developed which are targeted on particular activities rather than on defined areas.[133]

5.6. *Fisheries.*

On entry to the European Community (EC), there was a considerable body of domestic law relating to fisheries, most of which is still in force today, in so far as it is not inconsistent with Community Law.[134] Indeed some domestic laws, such as Section 4 of the Sea Fish (Conservation) Act 1967, is the basis for giving effect in the UK to the Community Conservation Measures, such as fish quotas.

The UK Fishery Act 1976, amended in 1981, enabled the UK to extend its fishery limits to 200 miles in accordance with EC law and provide national control of the area. Such national control includes:

- Fishermen, vessels and equipment licensing.
- Determination of fixed quotas and fish minimum length limits.
- Closed seasons, restricted area, gear and vessel restriction determination.
- Requisition of log book and catch data.
- Enforcement and issuing of penalties.

UK fisheries legislation enables Ministers to make provisions by Order, to the effect of the Acts. Such Orders include:

- The Haddock (North Sea) Licensing Order, 1978.
- The Immature Sea Fish Order, 1979.
- British Fishing Boats Order, 1983.
- Sea Fishing (Enforcement of Community Quota Measures) Order, 1991.
- Sea Fishing (Days in Port) Regulations, 1991.

Orders such as these are issued in Scotland by the Scottish Office Agriculture and Fisheries Department (SOAFD).

Of special importance in Scotland is the management of inshore fisheries, which is governed by the Inshore Fisheries (Scotland) Act 1984, which was revised in 1989 with a formal review in 1992. The Secretary of State for Scotland, after consultation with the fishing industry, can make Orders to regulate activity in Scottish inshore waters up to 6 miles from the coast. Seasonal restrictions may exist on the use of mobile gear in areas sensitive from a fish conservation perspective. For example, in the Moray Firth there are restrictions on suction dredging for shellfish in the Inverness, Cromarty and Dornoch Firths and on mobile gear, again in the inner Firths and Sinclair's Bay in Caithness. The Secretary of State may also establish licensing conditions.

When the UK joined the EC in 1973 it became bound to the existing Community's fishery laws, including the Treaty of Brussels (1967) incorporating the Paris and Rome Treaties and the existing Common Fisheries Policy (CFP). This newly formed and muddled CFP was accepted by the UK, then keen to become an Community member, but not by other countries such as Norway, who would not accept it.[134] With the accession to 200 mile Exclusive Economic Zone (EEZ) declarations by the EC in accordance with the Hague Resolutions of the 3rd of November 1976, a new CFP was inevitable, and reached in 1983.

The essence of the new CFP policy is that member states are not discriminated against by other member states when regulating fishing in their coastal waters and that, ultimately, stocks are conserved and over-capitalisation is avoided.[135] The CFP system adopts Total Allowable Catches (TAC's) in which quotas are set each year for each fishery, based partly on independent scientific advice, and divided up between the member states on a fixed percentage basis, taking into account traditional fishing patterns.[134] The fishery is closed once the quota has been caught. The other main CFP fishing regulatory method is through its Technical Conservation Measures. These include rules such as minimum mesh sizes, minimum landing sizes, closed seasons and areas, prohibition of certain gear and fishing vessel types, restrictive licensing, fee charging and the use of property rights.[136] Each

member state is responsible for ensuring that its fishermen and other fishermen in its coastal waters abide by the various regulations and are closely monitored by the communities inspectors.[137] The 1983 settlement also covered the common organisation of the market in fish and fish products and a policy for restructuring the community fleet during 1987-97, designed to address the problem of over capacity. This policy included measures for financial assistance to aid building and modernisation of fishing vessels.

Britain also has separate fishing agreements with Norway, the Faeroe Islands and Sweden.

5.6.1. Scottish Office Agriculture and Fisheries Department (SOAFD).

As stated previously, the Scottish Office Agricultural and Fisheries Department (SOAFD) is responsible in Scotland for the administration of the aforementioned fishery laws and regulations. The administrative headquarters of SOAFD is in Edinburgh, with Fisheries Inspectorate staff stationed at nineteen district offices and one sub-office covering the whole Scottish coast.[138] SOAFD is also responsible for fisheries research as well as fisheries protection within Scottish waters. The various roles played by SOAFD in fisheries matters are carried out by the following sectors of the department.

5.6 .1.1. *Division E.*

Branch 3 of this Division deals with the following main issues; EC co-ordination, co-operation, marketing and structural support for fisheries. Specifically, it deals with; EC processing and marketing grants, EC grants for improvements to facilities at fishing ports, grants for fishing vessels and grants and loans to Fishery Harbour Authorities.

5.6.1.2. *Division J.*

There are four branches in this Division that deal with various fisheries issues. Branch 1 is concerned with; fish stock conservation, the structure of the fishing fleet, decommissioning policy, Common Fisheries Policy, Total Allowable Catches (TACs), quotas, registration of vessels, socio-economic measures for the fishing industry and inshore fisheries. Branch 2 is concerned with; licensing policy, quota management, fishing effort control and liaison with fish producers organisations. Areas of involvement for Branch 3 include fish marketing and trade policy, as well as liaison with the Sea Fish Industry Authority (see

Section 5.6.5). The final branch in this Division of SOAFD is Branch 4. It is concerned with statistics relating to fisheries, for example, statistics on sea fish landings and vessels in the Scottish fishing fleet.

5.6.1.3. *Fisheries Research Service.*

The SOAFD Marine Laboratory in Aberdeen carries out marine, estuarine and freshwater research authorised by a committee chaired by the SOAFD Fisheries Secretary. The laboratories scientific programme supports the fisheries management responsibilities of SOAFD. The objective is to monitor the state of the main fish stocks. Effort is aimed at conserving and managing fish and shellfish resources to support an efficient, market oriented fishing industry. The Service is also responsible for marine environmental research, monitoring and licensing responsibilities related to the Food and Environmental Protection Act 1985, the Control of Pollution Act 1974 and North Sea oil activities.

5.6.1.4. *Scottish Fisheries Protection Agency (SFPA).*

The aim of the Agency is to enforce fisheries legislation and assist in the conservation of fish stocks. Its objectives are to deter illegal fishing, detect offences and provide intelligence on fishing activity.[139] At present the Agency has a fleet of four fishery protection cruisers, two launches 65 feet in length and two smaller quick patrol boats.

5.6.2. Foreign and Commonwealth Office (FCO).

The Foreign and Commonwealth Office (FCO) is also concerned with fisheries matters, this government department has a responsibility in consultation with SOAFD for international negotiations on fisheries matters. For example, with the other community countries on the development of the Common Fisheries Policy (CFP).

5.6.3. Department of Transport (DoT).

Within Great Britain the Department of Transport (DoT) Marine Directorate (see 5.11.1.1) is responsible for safety regulations at sea, which includes fishing vessels.

5.6.4. Ministry of Defence (MoD).

The Ministry of Defence (MoD) provides ships and aircraft of the Royal Navy and Royal Air Force, which are used to enforce fishery laws at sea.

5.6.5. Sea Fish Industry Authority.

The Sea Fish Industry Authority is an authority which is separate from the government and is concerned with the fishing industry. The functions of this authority include; development of new equipment and techniques up to the point where they can be applied commercially in fishing operations, or in the processing and distribution chain, carrying out regional fisheries and port development studies, providing training courses in fisheries technology and business management, producing a unique series of charts showing seabed obstructions (Kingfisher charts) and working closely with industry, research organisations and universities on fisheries related marine research.[140]

Fisheries research and development, of which, fish stock assessment is a major area, is carried out by the Sea Fish Industry Authority in conjunction with the Natural Environment Research Council (NERC), who along with the Engineering and Physical Science Research Council (EPSRC), also provide post graduate grants for research relating to fisheries matters.

5.6.6. Fishermen's Associations.

As for the fishermen and boat owners themselves, practically all are members of one of the associations which look after fishermen's interests. For example, the Scottish Fishermen's Federation and the Aberdeen Fishing Vessel Owners Association.[141] These associations are able to represent fishermen's views and engage in consultations with government departments and other agencies. They can also aid the establishment of local management agreements, for example, the Code of Practice that exists within the Moray Firth between the hydrocarbon and fisheries industries.

5.7. *Aquaculture.*

The management regime confronting a prospective coastal fish farmer is very different from that regulating land based or fresh water aquaculturists, since all such enterprises fall outwith the provisions of the Town and Country Planning (Scotland) Act 1972.

The starting point for any discussion of the legal regulation of a prospective marine fin-fish or shellfish farm lies in the rights of the Crown in respect of the ownership of the foreshore

and the seabed. The essential principle is that of Crown ownership of the foreshore and seabed beneath coastal waters and tidal estuaries. This ownership extends from the foreshore to the limits of the territorial sea. Traditionally this encompassed the seabed to a distance of three nautical miles, measured seaward from the low water mark. However, the distance has recently been extended to a distance of twelve nautical miles from baselines established by Order in Council by the Territorial Sea Act 1987.[142]

At the present time, the control of marine aquaculture developments is the responsibility of the landlord, which as a result of the Crowns ownership of the seabed, is the Crown Estate, which in turn is controlled by the Crown Estate Commissioners (CEC). Therefore, any potential fin-fish or shellfish farm developer must apply to the Crown Estate in order to lease the area proposed for the farm. Since the start of the boom in marine aquaculture in the early 1980's, the Crown Estate has developed a broad based consultative framework for dealing with all applications for potential aquacultural developments.[143] This procedure has four distinct parts which are outlined below.

5.7.1. Informal Checking.

Early contact with the Crown Estate Office in Edinburgh is encouraged in order to check whether a proposed site is available for leasing and whether there are any serious constraints on its development, for example, the proximity of existing fish farms. Any indications at this stage of potential areas are subject to the full appraisal system which follows the submission of a formal application.

5.7.2. Formal Application.

Applications for inshore leases for fish farms are made on a short standard form providing basic information on the proposed site, the species to be farmed, the type and scale of equipment and any proposals for onshore development.[144] The application form relates not only to the lease but also to the consent which is necessary from the Secretary of State for Transport under Section 34 of the Coast Protection Act 1949.[145]

In July 1988, the government introduced the Environmental Assessment (Salmon Farming in Marine Waters) Regulations 1988, thus implementing the European Directive on

Environmental Assessment (85/337/EC). As a result, from the 15th of July 1988 applications to the Crown Estate for salmon farming leases must be submitted with a supplementary environmental statement. The scope and detail of the statement should provide adequate information for an assessment of the affect of the project, but it is not expected to be a lengthy or costly report. At present, there are no such regulations concerning any other types of fin-fish or shellfish farms.[143]

5.7.3. Consultations.

Following formal application the application is subject to the extensive consultation system operated by the Crown Estate. This includes consultation with the general public by advertising the proposals in a relevant local newspaper and exhibiting the application form and plans in an appropriate post office. Copies are also sent to a wide range of relevant authorities, agencies and interested groups drawn from a full list of consultee's, which is shown in Table 43 below.

Table 43: Consultation List for Fish Farming Applications.[146]

Interest Groups	Consultee's
Existing Leaseholders	Recorded Leaseholders & Other Potential Developers
Landowners / Tenants	Recorded Landowners, Scottish Landowners Federation Scottish Crofters Union, National Farmers Union of Scotland
Fishermen	Salmon Fishery Owners, Scottish Office Agri. & Fisheries Dept. Scottish Fisheries' Federation, Local Fishermen's Association
Navigation	Department of Transport, Her Majesty's Coast guard, Royal Yachting Association, Port / Harbour Authorities, Ministry of Defence
Other Departments / Agencies	Highlands & Islands Development Board, Crofters' Commission Forestry Commission, Scottish Natural Heritage
Local Authorities	Regional / General Planning Authority, District Planning Authority River Purification Boards
Conservation Societies	National Trust for Scotland, Scottish Wildlife Trust, Royal Society for Protection of Birds, Association for the Protection of Rural Scotland
General Public	Respondents to Newspaper Advertisements, Respondents to Post Office Notices, Special Interest Groups

Table 43 is an indicative list of the principal groups with an interest in fish farming proposals. Applications are sent by the Crown Estate to the most relevant groups in each case, and other bodies and individuals responding to the public advertisement. Applicants

may be approached directly by consultee's seeking clarification of proposals or supplementary information.[144] The most relevant groups are:

5.7.3.1. *Department of Transport (DoT).*

Coastal fin-fish and shellfish farms require the consent of the Marine Directorate of the Department of Transport (DoT) (see Section 5.11.1.1) due to its role as navigational authority. The legal reason for DoT involvement lies in Section 34(1) of the Coast Protection Act 1949, as amended by Section 36(1) of the Merchant Shipping Act 1988, which is concerned with the restriction of works detrimental to navigation. Specifically this section provides that, –"no person may, without the consent in writing of the Secretary of State for Transport, carry out any of the following operations if the operation, whether while being carried out or subsequently, causes or is likely to result in obstruction or danger to navigation:

- Obstruct, alter or improve any works on, under or over any part of the seashore lying below the level of mean high water spring.
- Deposit any object or any materials on any such part of the seashore.
- Remove any object or any materials on any such part of the seashore lying below the level of mean low water spring."[142]

5.7.3.2. *Regional and District Council's.*

The relevant planning authorities are notified by the Crown Estate of farm applications in sea areas to enable them to indicate any onshore constraints and general views on the proposals. Within the Moray Firth the relevant authorities would be Highland Regional, Moray, and Banff and Buchan District Council's. Planning permission will usually be necessary for the onshore development and an application for this should be submitted to the planning authority in the usual way (see Section 5.4.4), as soon as possible.

5.7.3.3. *River Purification Boards. (RPBs)*

Consent will be required from the appropriate River Purification Board (RPB) for the discharge of effluent from a fish farm into a sea area within the Boards territory. Within the Moray Firth consultation would take place with either Highland River Purification

Board (HRPB), or the North East River Purification Board (NERPB). Initial consultations by the Crown Estate give the River Purification Boards the opportunity of indicating any general constraints within an area. The formal response to an application for effluent consent may stipulate special controls, standards and monitoring.

5.7.3.4. *Scottish Office Agriculture and Fisheries Department (SOAFD).*

As well as being involved in fisheries matters (see Section 5.6.1.1) Division E of SOAFD is also concerned with fish farming policy. Also, all fish farms have to be registered with Branch 4 of the Division for disease control purposes, and various procedures are then laid down for the notification of specific diseases and for treatments and disposal.

5.7.3.5. *Highland and Islands Enterprise (HIE).*

Financial assistance for fish farming projects is provided via grants and loans from Highland and Islands Enterprise (HIE) after detailed consideration of submitted proposals. Pilot schemes are usually stipulated for new sites or innovations in equipment and management, and various limits and priorities are adopted in allocating funds. Highland and Islands Enterprise (HIE) also provides technical and managerial advice to operators and potential new developers.

5.7.3.6. *Scottish Natural Heritage (SNH).*

Scottish Natural Heritage (SNH) is consulted by the Crown Estate Commissioners (CEC) in order to identify the likely consequences the presence of a fish farm would have on the surrounding marine environment.

5.7.4. Appraisals and Decisions.

Most fish farming applications can be processed by the Crown Estate within 3 to 4 months of submission. At least half of this period is taken up by the consultation procedure and associated discussions. Thereafter, there is a detailed appraisal of the comments received and of the possible impacts on; navigation, sailing, fishing, amenity, ecology and existing fish farms. From this comprehensive process decisions have to be reached to approve, modify or reject a lease application.[144] For cases which give rise to special difficulties,

because of such things as scale or location, an independent Advisory Committee has been established to assist the Crown Estate in its decision making.

5.8. *Aggregate Extraction.*

There are many constraints on aggregate extraction operations, including such things as; navigation, fisheries, coastal erosion, military areas, energy sources and communications cables. Because of these constraints licences are now rarely issued for areas closer than five miles from the coast.

In the UK three major Acts establish the legal arena for the dredging of marine aggregates, which is controlled by the Crown Estate (see Section 5.8.1), these are:

- Crown Estate Act 1961.
- Continental Shelf Act 1964.
- Territorial Sea Act 1987.[147]

5.8.1. The Crown Estate.

The Crown Estate Commissioners (CEC) are responsible for the proprietary rights of the Crown in tidal waters, and administer control over the exploitation of aggregates within the marine environment. This control was established in the 1961 Crown Estate Act. The area of control is restricted to the territorial sea and the continental shelf, with these areas being defined in the 1987 Territorial Sea Act and the 1964 Continental Shelf Act respectively. The 1987 Territorial Sea Act extended the limit of the UK's territorial sea to 12 nautical miles, corresponding with Article 3 of the UN Convention on the Law of the Sea.

The Crown Estate operates strict and complex licensing procedures, which are designed to be as searching as planning regulations concerned with the terrestrial environment. In the UK two types of licence must be granted before extraction can take place:

- A prospecting licence.
- An extraction licence.

5.8.1.1. *Prospecting Licences*

These are granted by the CEC after they have consulted with key government departments and Hydraulics Research Limited (HRS), a private consultant commissioned by the CEC. Prospecting licences generally stipulate a maximum sample tonnage of 500 tonnes, and are valid for a period of between six months and two years. Only a limited number of these licences are granted.

5.8.1.2. *Extraction Licences*

After proving the presence of suitable material, the dredging company must make an application to the CEC for an extraction licence. Before such an application is made, the applicant must produce a detailed management plan along with the results of their prospecting. The CEC will then enter into further consultation with the following agencies:

- The Scottish Office Agriculture and Fisheries Department (SOAFD), to make sure any development would not adversely affect fish stocks or fishing activity (see Section 5.6.1).
- The Department of Transport (DoT), on navigational grounds (see 5.7.3.1).
- The Department of Trade and Industry (DTI).
- The Hydrographic Department of the Ministry of Defence (MoD).
- Coast Protection Authorities with statutory responsibility for sea defence and flood protection.
- Scottish Natural Heritage (SHN).
- Other environmental interests.

The procedure also stipulates that the Crown Estate advertises all applications for production licences in local papers and the fish trade press, in order to enable comment from the general public.

In addition to the above consultations, professional advice from consultants will be sought once more on the possible detrimental consequences that dredging could cause in the particular area under review. If it is found that the proposed extraction would lead to coastal erosion the CEC have no hesitation in rejecting the application. However, it is

important to note that amendments may be made to the application to remove risk of adverse effects. Advice from government departments establishes whether the overall impact will be large enough to warrant an environmental assessment in accordance with the European Community Directive on Environmental Assessment (OJL175, 5/7/85).[148]

5.8.2. Scottish Office Environment Department (SOEnD).

In Scotland, the responses to the consultations are passed to the Scottish Office Environment Department (SOEnD), specifically the Planning Services Territorial Groups 1 and 2, which are responsible for the formulation of the Government View. The Crown Estate does not issue a licence if there is a negative Government View, and it accepts in every case all conditions included in a favourable View by incorporating them in its licence. Thus, such conditions of a licence are contractual terms and are therefore legally enforceable as such by the Commissioners. Importantly, the Government View procedure was revised in 1989 and now incorporates environmental assessment requirements.[133]

5.9. *Hydrocarbons.*

Departmental responsibility for policy and enforcement of regulations for the UK's oil and gas production industry now lies primarily with the Department of Trade and Industry (DTI), which includes the former Department of Energy.[139]

Under the Petroleum (Production) Act 1934 a licence is required from the DTI in order to explore for or extract oil or gas on land or on the UK Continental Shelf (UKCS). Such licences may carry conditions, restrictions or inhibitions on activity. These may require licensees to consult or notify interested parties of exploration or development plans, they may include seasonal restrictions on activities, or designate particular parts of a licensed area as either no-go areas or, for example, areas which cannot be drilled. The making of such conditions follows full consultation with other government departments and agencies.

The resulting licence conditions, restrictions and inhibitions relate specifically to the licensed area concerned. The government has no general regulatory power to apply the conditions agreed for new licences retrospectively to those already in existence. However the Secretary of State has a further, limited opportunity, to consider additional

environmental conditions when programmes for the development of a field or the abandonment of structures and pipelines offshore are being agreed. Development consent conditions are agreed under the Model Clauses attached to each licence. Conditions related to the abandonment of offshore structures and pipelines are attached to the abandonment programmes agreed under the Petroleum Act 1987. In both cases the Secretary of State has the power to impose programmes or conditions where these are not agreed.[133] Current conditions and restrictions in force on various licences reflect environmental, fishing, defence and transport interests. Applicants for licences carry out analyses of environmental impact which may also include the potential impact on leisure activities and amenities.

The Department of Trade and Industry's main link with the industry is through the UK Offshore Operators Association (UKOOA), but the department also maintains contacts with other relevant organisations, such as; the Trade Union Congress (TUC), individual trade unions, the International Association of Drilling Contractors and the Association of Offshore Diving Contractors (AODC).

The Fisheries and Offshore Oil Consultative Group set up by the government in 1974 provides a forum for the offshore hydrocarbon and fishing industries to keep under review developments in connection with the exploration of oil and gas resources, with the object of fostering close relations between the two industries. The Secretariat is provided by the Scottish Office Agriculture and Fisheries Department (SOAFD). It was as a result of this groups efforts that a Code of Practice –"to provide ground rules for the conduct of exploitation development and production activities with special regard to the interests of fishing activity," were draw up concerning the Moray Firth (see Section 8.3.1).

Responsibility for the occupational health and safety of those working on or in connection with offshore installations and submarine pipelines is vested in the Health and Safety Commission (HSC), with the Health and Safety Executive (HSE) as its executive arm, under the Health and Safety at Work etc Act 1974.

Particular areas of government departmental and agency responsibility are itemised below.

5.9.1. Department of Employment (DEmp). Health and Safety Commission (HSC) and Health and Safety Executive (HSE).

The Health and Safety at Work etc Act 1974 established the Health and Safety Commission (HSC), whose executive arm is the Health and Safety Executive (HSE). In the area of marine interests the responsibilities of the HSC have been extended as a result of the Order in Council 1977, the Health and Safety at Work etc Act 1974 (application outside Great Britain) Order 1977, SI 1977 N° 1232, to the following specified activities within territorial waters adjacent to Great Britain and designated areas of the UKCS:

- Construction, reconstruction, alteration, repair, maintenance, cleaning, demolition and dismantling of any buildings or other structure not being a vessel.
- Loading, unloading, fuelling or provisioning of a vessel.
- Diving operations.
- Pipeline works and certain activities connected therewith.
- Offshore installations.
- The construction, repair, maintenance, cleaning, demolition and dismantling of a vessel, except when carried out by the master, officers or crew members.
- Docks.
- Shipping.

5.9.1.1. *Offshore Safety Division - Branch 1. Policy and Legislation.*

This branch of the Division deals with policy and legislation on offshore safety, it advises the Health and Safety Commission (HSC) and issues exemptions from safety regulations.

5.9.1.2. *Offshore Safety Division - Branch 3. Safety Management Systems.*

As this Divisional branch title suggests, Branch 3 deals with safety management systems.

5.9.1.3. *Offshore Safety Division - Branch 4. Well Operations and Structures.*

This Division is concerned with; the registration and certification of offshore installations and there managers, preparation of guidance for the design and construction of offshore

installations, the control, monitoring of, and liaison with the departments Certifying Authorities, the well operations consent systems and liaison with the Department of Transport (DoT) Marine Directorate on fire fighting equipment.

5.9.1.4. *Offshore Safety Division - Branch 5. Inspection of Marine Safety.*

This branch of the Division is involved in; enforcement activities to ensure the safety, health and welfare of persons on offshore installations, inspectional functions of day to day operations, safety inspections, accident investigations, liaison with the Department of Transport (DoT) Marine Directorate, Health and Safety Executive (HSE) oil spill contingency planning, general policy on environmental aspects of offshore oil and gas activities, the protection of offshore installations and monitoring of the training of offshore workers.

5.9.1.5. *Offshore Safety Division - Branch 6. Pipelines.*

The pipeline branch of the Division are the administrators of the Pipelines Act 1962 and Part III of the Petroleum and Submarine Pipelines Act 1975. It is also in charge of regulating construction of new pipelines, monitoring operational standards of existing pipelines and safety and inspection policy.

5.9.1.6. *Offshore Safety Division - Branch 7. Diving.*

The diving branch enforces and promotes safe offshore diving operations and the health and safety of the diving workforce. The branch provides guidance on diving matters to the Department of Transport (DoT) Marine Directorate and the Health and Safety Executive.

5.9.1.7. *Offshore Safety Division - Branch 8. Technology Development.*

This branch carries out research and development related to offshore safety.

5.9.2. Department of Trade and Industry (DTI).

5.9.2.1. *Offshore Supplies Office (OSO).*

The Offshore Supplies Office (OSO) is responsible, within government, for the UK offshore supplies industry. It provides the Secretariat for the Offshore Industry Advisory Board and its sub-committees, which provide advice about the industry to Energy Ministers. There are four Branches within the OSO.

Branch 1 is involved in liaison with UKCS Offshore operators, promotion of UK offshore industrial capability, support for OSO export and research and development activities and, analysis of quarterly returns from UKCS operators. Branch 2 is concerned with exports and administration, while Branch 3 is concerned with research and development. It supports research and development in offshore technology to assist UK organisations to develop new technologies and to compete on the UKCS and world-wide. Branch 4 is the policy unit and deals with OSO policies and international issues.

5.9.2.2. *Oil and Gas Division - Branch 1.*

The interests of this government branch include; UKCS oil and gas policy, co-ordination of UKCS policy, field and pipeline developments, the international crude oil market, OPEC and consumer / producer relations, co-ordination of oil and gas EC issues, department interests in the UKCS fiscal regime, the gas levy and ERDF payments.

5.9.2.3. *Oil and Gas Division - Branch 2.*

The Continental Shelf Act 1964 vested in the Crown the right to explore and exploit the natural resources of the seabed and subsoil beyond territorial waters and extend the relevant provisions of the Petroleum (Production) Act 1934 to the Continental Shelf.[138]

Petroleum exploration and production licences are issued under these Acts by the Department of Trade and Industry's (DTI) Oil and Gas Division - Branch 2. There are two sections within this branch, Section A deals with licence administration while Section B deals with seaward production licensing.

In exercising control, Branch 2 liaise's with other government departments including, the Ministry of Defence (MoD) and the Scottish Office Agriculture and Fisheries Department (SOAFD), and companies that may have submerged cables in the area, for example, British Telecommunications (BT).

5.9.2.4. *Oil and Gas Division - Branch 3.*

Branch 3 is concerned with the co-ordination of the UKCS policy, the UN Law of the Sea Convention, delimitation of the UKCS, oil field finance and abandonment of disused oil and gas installations. There are two sections within Branch 3.

Section A, this section is concerned with; co-ordination of policy on UKCS development, preparation of the 'Brown Book', oil depletion, offshore employment, civil liability for oil pollution from offshore installations, abandonment of disused oil and gas installations and oil field finance.

Section B, this section is concerned with; the UN Law of the Sea Conventions, delimitation of the UKCS and UK / Norwegian oil matters, including development of cross boundary line fields.

5.9.2.5. *Petroleum Engineering Division - Branch 1. Exploration, Geology and Geophysics.*

This Division branch is concerned with; all aspects of exploration and appraisal related to the search for oil and gas, geology and geophysics of oil discoveries and fields, licensing and selection of blocks, negotiation of work programmes; determination of oil fields for Petroleum Revenue Tax, well appraisals, assessment of undiscovered reserves, management of the British Geological Surveys and the Institute of Oceanographic Sciences offshore related contracts and finally management of the Well Record Centre and Data Administration.

5.9.2.6. *Petroleum Engineering Division - Branch 2. Reservoir Development, Reservoir Engineering and Petrophysics.*

Branch 2 of the Petroleum Engineering Division is involved with the technical development of oil and gas fields and the calculation of discovered oil and gas reserves. It

also monitors production performance, runs simulations of reservoirs and enhanced oil recovery and manages the Petroleum Production Reporting System.

5.9.2.7. *Petroleum Engineering Division - Branch 3. Production Engineering.*

The functions of this branch of the Petroleum Engineering Division include; liaison with field operators on the probable timing and form of future offshore hydrocarbon developments, co-ordination of the Department of Trade and Industry's (DTI) review of field development plans through to approval and provision of an interface with the field operators, evaluation of the technical aspects of field equipment and facilities described in development plans and the monitoring of the progress of field development schemes from approval through to fully operational status. Branch 3 is also the focal point in the Division for information on offshore technology, including transportation of oil and gas and abandonment.

5.9.3. Department of Employment and Department of Trade and Industry.

5.9.3.1. *Marine Technology Support Unit (MaTSU).*

The Marine Technology Support Unit (MaTSU) serves as the executive arm of the Department of Employment's Health and Safety Executive (HSE) Offshore Safety Division and the Department of Trade and Industry's (DTI) Offshore Supplies Office and Petroleum Engineering Directorate in the monitoring of their offshore technology research and development projects.

MaTSU is widely represented on a variety of government committees and maintains contact with a number of departments. The Unit forms a bridge between government and companies in the offshore technology field.

5.9.4. Scottish Office Environment Department (SOEnD).

5.9.4.1. *Rural Affairs and Natural Heritage Division.*

Branch 1 of the Scottish Office Environment Department's (SOEnD) Rural Affairs and Natural Heritage Division deals with the Offshore Petroleum Development (Scotland) Act 1975, which involves the licensing of marine operations in designated sea areas.[139]

5.9.5. Oil and Gas Associated Agencies.

5.9.5.1. *United Kingdom Offshore Operators Association Limited (UKOOA).*

The function of this agency is to provide an industry forum for discussions on technical and administrative matters common to oil companies producing and exploring in offshore UK waters. To the extent appropriate and practical, UKOOA provides for the industry, on such technical and administrative matters, a means of communication with government departments and other bodies.

5.9.5.2. *Association of Offshore Diving Contractors (AODC).*

The Association of Offshore Diving Contractors (AODC) is the trade association which represents the interests of the offshore diving and underwater engineering contractors working in the north west European continental shelf area. Its members include; British, Norwegian, French, American, Italian, Dutch and Swedish companies.

AODC's principal aim is to improve the safety standards of the diving and underwater engineering industry, and to this end it liaise's with government departments and other trade groups regarding the formulation of regulations, codes and guidance notes. It also represents the interests of its members on other matters when and wherever required.[140]

5.10. *Waste Disposal.*

Pollution of the coastal zone marine environment can arise from both the land and sea based activities. Within Scotland, the main government departments, agencies and independent bodies responsible for the control of pollution are outlined below.

5.10.1. Department of Transport (DoT).

5.10.1.1. *Marine Directorate.*

At present the Department of Transport (DoT) Marine Directorate (see Section 5.11.1.1) has the responsibility for dealing with oil, chemical and garbage pollution at sea from ships.[139] The lead role is taken by the Directorates Marine Pollution Control Unit (MPCU) which was established in 1979 and is responsible for counter pollution operations at sea and on the shore when major harm is threatened and is also in charge of contingency

planning to meet such events. MPCU also deals with the governments claims against polluters or their insurers.[149]

5.10.2. Regional and District Council's.

Once a pollutant reaches land, Regional and District Council's are mainly responsible for clean up operations, but in cases of large scale environmental damage MPCU will take control. MPCU sets up a coastal pollution co-ordination centre to handle the crisis and issues appropriate equipment to deal with the pollution from its central stocks.[149]

5.10.3. Scottish Office Environment Department (SOEnD).

5.10.3.1 *Engineering and Waste Water Directorate.*

The Scottish Office Environment Department (SOEnD) is responsible at central government level for policy on the protection of beaches and inshore waters from pollution.[150] Divisions 1 and 4 of the Engineering and Waste Water Directorate are responsible for technical policy and legislative aspects of water pollution control including; EC Directives on urban waste water treatment, bathing water, shellfish waters and dangerous substances. These responsibilities lie under the Rivers (Prevention of Pollution) (Scotland) Acts 1951 and 1965, the Prevention of Oil Pollution Act 1971 and the Control of Pollution Act 1974 Part II.[139]

5.10.4. Scottish Office Agriculture and Fisheries Department (SOAFD).

5.11.4.1. *Division K.*

Branch 3 of the Scottish Office Agriculture and Fisheries Departments (SOAFD) Division K is concerned with marine pollution emergencies and the disposal of waste at sea. These responsibilities lie under Part II of the Food and Environmental Protection Act 1985 (see Section 5.14.2.1). In licensing disposal at sea the Act requires account to be taken of; the need to protect the marine environment, the living resources which it supports, public health and to prevent interference with legitimate uses of the sea.[133] Where oil pollution occurs, SOAFD is responsible for advising on the use of dispersants and their potential impact on fisheries in the area of the spillage.[150]

5.10.5. Ministry of Defence (MoD).

The Ministry of Defence (MoD) is responsible for dealing with pollution from its own ships and for any incidents which occur within the limits of naval bases. In other cases, if requested by MPCU, the MoD will arrange for aircraft or helicopters to be provided for aerial surveillance during pollution incidents. The Ministry also advises on damaged vessels and the feasibility of various options to limit pollution, such as pumping out, refloating, repair, scuttling or sinking by controlled explosion.[150]

5.10.6. Department of Trade and Industry (DTI).

Pollution from offshore installations is dealt with by the Department of Trade and Industry (DTI) in consultation with the MPCU.[149]

5.10.7. River Purification Boards and HM Industrial Pollution Inspectorate.

River Purification Authorities were established by the Rivers (Prevention of Pollution) (Scotland) Act 1951, and entrusted by the Secretary of State for Scotland with the task of protecting and improving the quality of the water environment. Within the Moray Firth, the river purification boards of Highland (HRPB) and the North East (NERPB) exercise water pollution control powers derived primarily from the Control of Pollution Act 1974 as amended by Schedule 23 of the Water Act 1989. They also have enforcement powers under the Environmental Protection Act 1990.[139]

The River Purification Boards (RPBs) operate source to sea control of the catchment area over which they have jurisdiction, that is up to the low water line or closing lines of estuaries. To this must be added specific tidal areas as laid down in the River (Prevention of Pollution) (Scotland) Act 1965. Section 31 of the Act extended jurisdiction to include relevant territorial waters.

Under the Control of Pollution Act 1974 it is a criminal offence firstly to discharge any poisonous, noxious or polluting matter into the aquatic environment, and secondly to discharge any trade effluent without the consent of the river purification authority. The prime mechanism used for protecting the aquatic environment is a licensing procedure known as the consent system. In determining standards, the river purification board has to

take into account environmental quality standards (EQS) set by the Scottish Office Environment Department (SOEnD) or those laid down in EC Directives.[139]

Pollution from certain prescribed processes is subject to Integrated Pollution Control (IPC) which is managed jointly by Her Majesty's Industrial Pollution Inspectorate (HMIPI) and the river purification authorities under the provisions of the Environmental Protection Act 1990. This regime applies in particular to processes which discharge substances most harmful to the environment, including the marine environment, those on the UK's 'Red List'. As part of the control, HMIPI is required to consult the appropriate river purification authority before granting discharge consents and to take account of their requirements for achieving water quality objectives.[133]

5.10.8. Port and Harbour Authorities.

Port and harbour authorities are responsible for dealing with any pollution that occurs within their designated areas. If the pollution spreads outward from the port into the open sea, MPCU would then be involved. MPCU is also available to provide assistance if the scale of an incident threatens to overwhelm a port authorities resources, or if an authority requests their help.[150]

5.10.8. Scottish Natural Heritage (SNH).

Scottish Natural Heritage (SNH) is the governments statutory adviser on all matters concerning the conservation of the natural environment in Scotland. This includes the potential threat to the marine environment from pollution incidents at sea. SNH liaise's closely with voluntary nature, wildlife and animal welfare societies such as the Royal Society for the Protection of Birds (RSPB), and the Marine Conservation Society (MCS) as part of its advisory role.

5.11. *Navigation and Communication.*

Departmental responsibility for British merchant shipping lies with the Department of Transport (DoT). The Merchant Shipping Acts 1894-1988 are the principal legislative measures. Government departments, agencies and other organisations also concerned with shipping and navigation include; Her Majesty's Customs and Excise, the Health and Safety

Commission (HSC) and Health and Safety Executive (HSE), the Scottish Office Agriculture and Fisheries Department (SOAFD), the Foreign and Commonwealth Office (FCO), the Ministry of Defence (MoD), the Meteorological Office, Planning Authorities and the Science and Engineering Research Council (SERC). The role of these various groups are investigated below.

5.11.1. Department of Transport (DoT).

5.11.1.1. *Marine Directorate.*

The Marine Directorate is concerned generally with the administration of merchant shipping safety legislation and a wide range of other duties having both a direct and indirect bearing on such things as safety of life at sea and the prevention of pollution from ships and offshore installations. Areas of concern specifically include; port matters, maritime surveys, ship crew matters including casualties, navigational safety, search and rescue and pollution. These are discussed below.

The Ports Division of the Department of Transport (DoT) Marine Directorate is responsible for government policy on ports including; the structure and constitution of the industry, finance and development and appointments by the Secretary of State to harbour authorities. The Division also has responsibility for harbour authorities private legislation which enables them to develop below the low water mark. The Divisions Ports Office for Scotland deals with Scottish ports and matters that are related to North Sea oil development.

Under the Surveyor General, there is a Marine Survey Service of professional staff, both at Headquarters and local Marine Offices. These surveyors carryout a wide range of duties concerned with the safety of merchant ships (including submersible craft) covering survey, inspection and certification as required by the Merchant Shipping Acts and various International Conventions. Surveys of cargo ship safety, construction and load line are delegated to certain approved classification societies.

The Directorate's responsibilities on crew matters cover; training, certification, manning standards, conditions of service and all occupational safety matters on board UK ships.

The Directorate is also responsible for UK policy on safety of navigation and for consulting all UK interests concerned (see Section 5.7.3.1). It represents the UK in all international discussions of the subject, particularly with the International Maritime Organisation (IMO). It also deals with alleged breaches of the collision regulations and with civil hydrographic requirements.

The Directorate also controls the General Lighthouse Fund, which is derived from light dues which are collected by Her Majesty's Customs and Excise, which finances the three General Lighthouse Authorities. It is responsible for policy and legislation on pilotage and administers Part II of the Coastal Protection Act 1949 relating to works in tidal waters. The interests of ship owners are represented on the Lights Advisory Committee.[138]

The Directorate includes Her Majesty's Coast Guard which co-ordinates UK civil maritime search and rescue within the UK search and rescue region. There is a search and rescue Co-ordination Committee under the chairmanship of the Directorate. The Coast Guard is made up of some 580 regular coast guards and over 4,000 auxiliaries.

The pollution related responsibilities of the Directorate range from defining physical requirements on tankers such as; monitoring equipment, limitations on the size of tanks and ballast segregation, to controlling accidental and operational discharges from ships. The Marine Pollution Control Unit (MPCU) has specific responsibility for dealing with oil and chemical pollution at sea and for co-ordinating major beach cleaning operations (see Section 5.10.1). There is also a Standing Committee on Pollution Clearance at Sea.

5.11.1.2. *Shipping Policy Directorate.*

The Shipping Policy Directorate has three separate Branches. Branch 1 is concerned with the EC Common Shipping Policy. Branch 2 is concerned with bilateral shipping relations with all non European Countries and general relations with the British Shipping Council and British International Freight Association. Finally, Branch 3 deals with general policy towards the International Maritime Organisation (IMO) and the UN Law of the Sea Conference.

5.11.2. Foreign and Commonwealth Office (FCO).

The Foreign and Commonwealth Office (FCO) is consulted generally on marine matters in so far as they effect the UK's relations with other countries and international bodies or are affected by International Law. The FCO is responsible for co-ordinating UK policy on the Law of the Sea, in conjunction with other departments, in particular at the UN Law of the Sea Conference's. Therefore, in this role, the FCO specifically co-ordinates with Branch 3 of the Department of Transport (DoT) International Shipping Policy Directorate.

5.11.3. Ministry of Defence (MoD).

The Hydrographer of the Ministry of Defence (MoD) Hydrographic Office is responsible for issuing navigational warning, in consultation with the Department of Transport (DoT) Marine Directorate which pays for the service. The MoD Radio Navigation Warnings Station of the Hydrographic Office may also be required to issue navigational warnings during search and rescue operations. During such operations, Royal Navy and Royal Air Force ships and aircraft are available to carryout search and rescue duties.

Weather bulletins to shipping are put out by the MoD Meteorological office, the Marine Directorate also pays for this service.

5.11.4. Regional and District Council's.

Whether merchant shipping legislation is applicable to pleasure craft is dependent upon such factors as size, numbers carried and intended use of the craft. Where pleasure craft are not covered, licences are issued by local government.

5.11.5. Scottish Office Agriculture and Fisheries Department (SOAFD).

Branch 1 of the Scottish Office Agriculture and Fisheries Departments (SOAFD) Division J is responsible for the registration of fishing vessels. Registration covers safety regulations concerning construction, safety equipment and crew matters.[139]

5.11.6. Department of Employment (DEmp). Health and Safety Commission (HSC) / Health and Safety Executive (HSE).

The Health and Safety Commission (HSC) and its executive arm, the Health and Safety Executive (HSE) are responsible for all offshore safety within the coastal and territorial waters of the UK (see Section 5.9.1).

5.11.7. Her Majesty's Customs and Excise.

The clearance of ships to and from ports is the responsibility of Her Majesty's Customs and Excise at the port in question, on the production of the necessary documentation.[140]

5.11.8. Engineering & Physical Science Research Council (EPSRC).

The Engineering and Physical Science Research Council (EPSRC) supports research and post graduate training in a wide range of subjects related to shipping, from building and operation to navigation and safety aspect.

6.11.9. Communications.

Companies wishing to lay cables, for example, British Telecommunications (BT), are required to obtain the consent of the Department of Transport (DoT) and the Crown Estate Commissioners (CEC) to any proposals to lay a submarine cable. The cable owner in turn, is advised of all proposals involving dredging or work on the seabed connected with the oil and gas industry, and has the right to object if the activity would interfere with its cables.[138]

5.12. *Nature Conservation.*

5.12.1. Scottish Natural Heritage (SNH).

As is the case with nature conservation above the low water mark, Scottish Natural Heritage (SNH) is responsible for the designation of conservation areas below the low water mark.

5.12.1.1. *Marine Nature Reserves (MNRs).*

Marine Nature Reserves (MNRs) differ from most other designations in the UK in that they protect the sublittoral zone, whereas most other designations just cover the intertidal zone and above. The provisions for MNRs lie with the Wildlife and Countryside Act 1981. The Act states that reserves can be established within territorial waters of the UK and include both the sea and the seabed. The responsibility for MNRs in Scotland belongs to SNH, who are empowered to propose a reserve in which activities such as fishing, recreation and building operations, or even access may be restricted.[151]

Designating an MNR is a complex procedure, in Scotland SNH must first make an application to the Secretary of State for an MNR designation, which in practice is only accepted when there is voluntary co-operation between all the parties involved. This requires SNH to carry out extensive consultations with all interested parties, which has proved thus far to be extremely complex.[152] As a result there are currently no formally designated MNRs in Scotland.

5.12.1.2. *Marine Consultation Areas (MCAs).*

Below the low water mark in Scotland SNH has been able to identify marine areas termed Marine Consultation Areas (MCAs). These have no statutory authority but identify areas considered by SNH to be of particular distinction in respect to the quality and sensitivity of the marine environment. Twenty nine such areas had be identified by 1990, however none at present are situated within the Moray Firth.

The selection of MCAs allows bodies which consult with SNH to be aware of marine conservation issues within particular areas. The main use of MCAs by SNH has been in support of its response to consultations undertaken by the Crown Estate on proposed marine fish farm leases (see 5.7.3.6).[133]

5.13. *Recreation and Tourism.*

5.13.1. Scottish Sports Council.

The Scottish Sports Council was established in 1972 for the purposes of fostering the knowledge and practice of sport and physical recreation among the public at large and the provision of facilities. It represents the interests of sport and active recreational pursuits.

5.13.2. Local Authorities and Sports Clubs.

Coastal areas are used by large numbers of people for a wide range of recreational activities, ranging from swimming, rowing, diving and angling to power boating, water skiing and the use of jet skis. Co-operation between neighbouring local authorities and between authorities and sports clubs is encouraged in order to create coherent plans for recreational use of coastal areas which reconcile the interests of all participants.

The aim of coastal recreational management is that activities can be managed so as not to create conflict by co-ordinating planning of the use of the coastal resource, by provision of sites with suitable supporting facilities where there is extensive use and by education of the participants about respect for other users and for the environment.[133]

However, many of the activities taking place at or within the coastal waters of the UK require few specialised facilities, and many of the people taking part do not belong to any club or association. The majority of people who take part in coastal recreation and water sports generally just 'go out and do it', leaving little room for co-ordinated management.

One of the few areas where statutory powers apply to recreation is the power local authorities have to control the use of recreational craft up to 1,000m below the low water mark by making bye-laws under the Civic Government (Scotland) Act 1982. Such bye-laws can also set aside areas for bathing, regulate the navigation of all pleasure boats including power boats, water skiers and jet skies and also regulate there speed and require exhaust silencers to be fitted in order to reduce noise pollution.[133]

5.13.3. Scottish Office Environment Department (SOEnD).

Another area of statutory control relates to water quality. As stated in Section 5.10.3, the Scottish Office Environment Departments (SOEnD) Engineering and Waste Water Directorate ensures the execution of EC Directives relating to Bathing Water Quality.

5.14. *Coastal Engineering Works.*

Any kind of construction work below the high water mark has to obtain certain consents before work can commence.

5.14.1. Crown Estate.

As already stated, the Crown via the Crown Estate owns the seabed out to the limit of the territorial sea. Therefore, the area for any type of construction within the territorial sea has to be either bought, or more commonly, leased from the Crown Estate.

5.14.2. Scottish Office Agriculture and Fisheries Department (SOAFD).

The permanent deposition of substance or articles below the high water mark requires a licence under the Food and Environment Protection Act 1985, Part II, which replaced the

Dumping at sea Act 1974 and was slightly amended by the Environmental Protection Act 1990. Within this Act, permanent deposition includes any construction works and therefore a licence from the licensing authority must be obtained before work can commence. Within Scotland the licensing authority is the SOEnD.[152]

5.14.3. Department of Transport (DoT).

However, before any kind of work can begin, a consent is also needed from the Department of Transport on navigational grounds (see 5.7.3.1).

5.14.4. Regional Councils.

The Coastal Protection Act 1949, and the Flood Protection (Scotland) Act 1961, govern coastal defence and flood protection in Scotland respectively. These Acts give Regional Councils discretionary powers to protect the coast from erosion and encroachment from the sea, and non-agricultural land from flooding.

5.14.5. Department of Employment (DEmp). Health and Safety Commission (HSC) / Health and Safety Executive (HSE).

The safety of building and civil engineering operations in the territorial waters of the UK is the responsibility of the Health and Safety Commission (HSC) and its executive arm, the Health and Safety Executive (HSE) under the Health and Safety at Work etc Act 1974 (see Section 5.9.1).

5.14.6. Engineering and Physical Science Research Council (EPSRC).

Research is carried out and post graduate grants provided by the Engineering and Physical Science Research Council (EPSRC) for research in marine engineering related areas.

5.15. *Military Use.*

5.15.1. Ministry of Defence (MoD).

5.15.1.1. *PL (Lands) 3.*

The Ministry of Defence (MoD) uses the coast and sea around the UK for a variety of functions, such as naval bases, military exercises and weapons testing, under the auspices of the Military Lands Act 1900 and the Land Powers (Defence) Act 1958. Also, as already

mentioned the MoD is also involved in fisheries protection and search and rescue duties (see 5.6.1 & 5.11.3).

Military manoeuvres and weapons testing takes place in designated areas, for example, in the middle of the Moray Firth there is an area which is designated as being used for submarine exercises. The MoD is obliged to inform potential users of the areas of the dangers present, this involves informing the Department of Transport (DoT) Marine Directorate so that shipping can be informed about staying clear, especially in the light of recent accidents involving fishing vessels and submarines.

Another area of responsibility for the MoD is that of military remains on the seabed. There are many thousands of shipwrecks in UK coastal waters, some of which are important historic or military remains. The MoD is able to protect such sites from inappropriate interference by designating them under the Protection of Military Remains Act 1986. Under this Act it is an offence to tamper with aircraft or vessels, and associated human remains at a protected site.[133]

5.15.1.2. *PO (Lands) (Safeguarding and Bye-laws) Division.*

This Division is responsible for the bye-laws governing MoD practice ranges.[139]

5.15.1.3. *Hydrographic Office.*

Formed by Order in Council in 1795 to advise the government on hydrographic matters and to prepare charts, the Office is concerned with safety of navigation. Safety of Life at Sea Regulations (IMO) and UK Merchant Shipping (Carnegie) Rules 1975, require vessels to carry charts.[139]

Chapter 6: Identification of Actual and Potential Conflicts within the Moray Firth Coastal Zone.

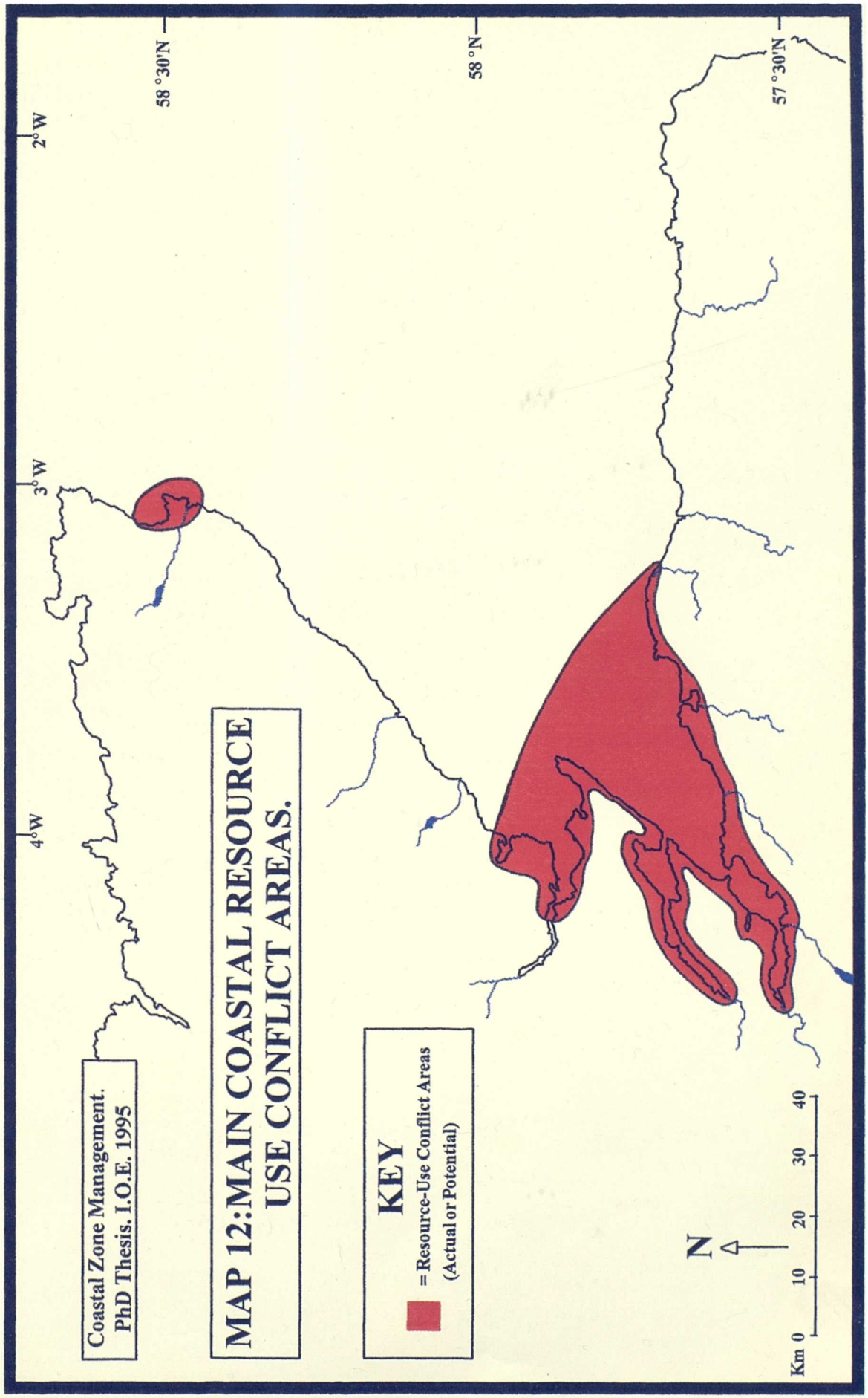
6.1. *Introduction.*

Many of the problems encountered in the coastal zone result from conflicts and misunderstandings between the different coastal users (see Chapter 4).

By the use of overlay analysis, it is possible to compare the maps concerned with the areas of key coastal ecosystems and critical habitats for wildlife within the Moray Firth coastal zone, with those maps concerned with areas of major coastal uses in order to identify the main areas where resource use conflict (actual or potential) may be present. On the resulting map (Map 12 over the page), shaded areas denote actual or potential resource use conflict areas. Specifically, there are two areas of actual or potential resource use conflict within the Moray Firth. The majority of the main area consists of the area described by Smith (1986) as the inner Moray Firth area (see Section 3.1), while the other lesser area is centred around the Wick / Sinclair's Bay area. Such a preliminary analysis points to these areas as being in most need of management.[40]

The identification of specific resource use conflicts occurring within the Moray Firth formed the focus of the rest of this chapter. This involved the verification of expressed concerns, both through data analysis and direct consultation, which is essential if conflicts which cause deterioration of the coastal resource, or serious disharmony between it users are to be properly identified and evaluated.[126]

Information regarding conflicts of use within the Moray Firth coastal zone was gathered from existing data and via the use of questionnaires. Chapter 4 outlines how questionnaires were sent out to the different users of the Moray Firth. Each questionnaire sent out contained a question relating to coastal conflicts of use, or was specifically aimed at such conflicts. Examples of the questionnaires used can be found in Appendix 2.


MAP 12:MAIN COASTAL RESOURCE USE CONFLICT AREAS.
Coastal Zone Management. PhD Thesis. I.O.E. 1995
KEY
= Resource-Use Conflict Areas (Actual or Potential)
N
Km 0 10 20 30 40
4°W
3°W
2°W
58 °30'N
58 °N
57 °30'N

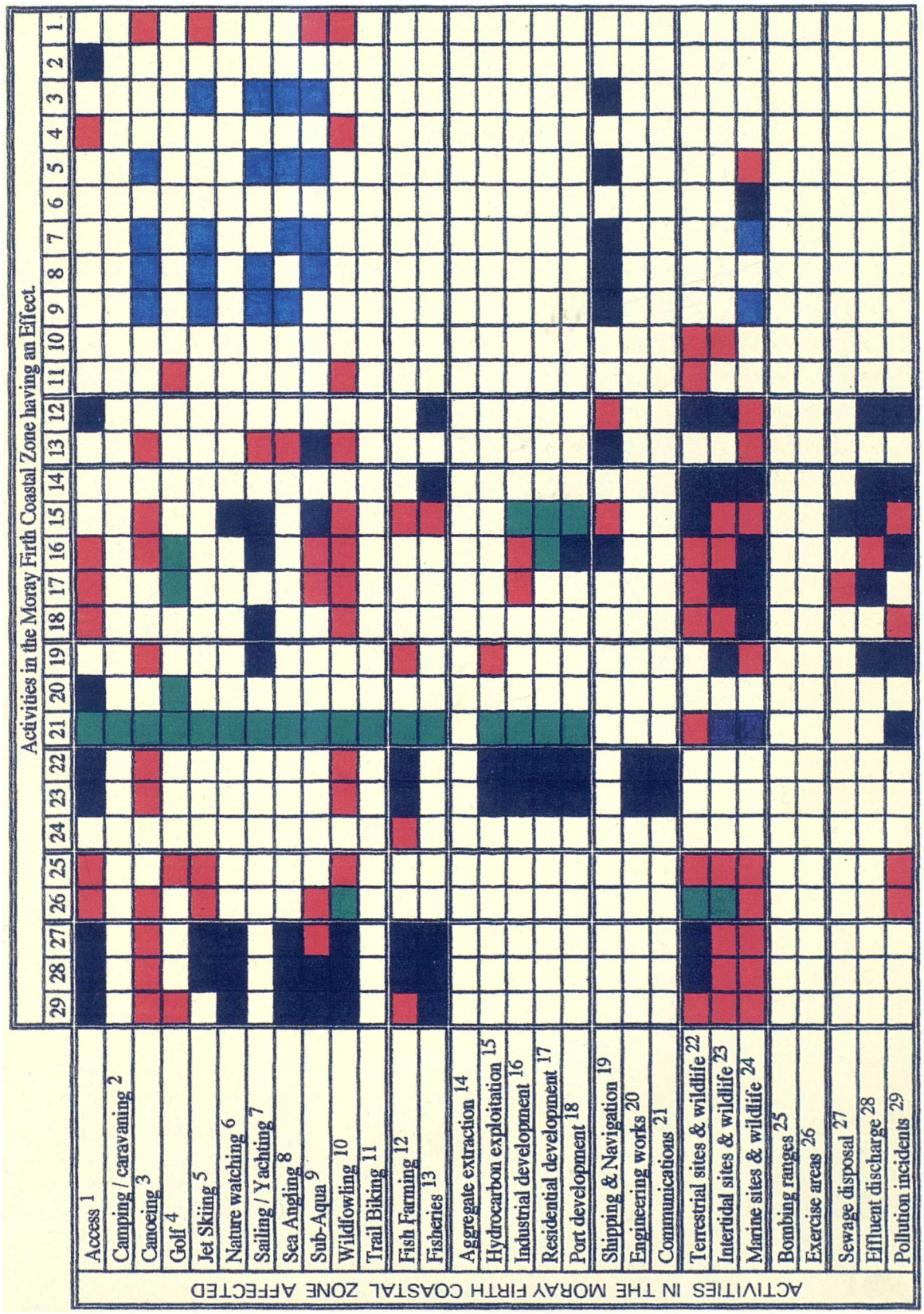
Having collected data and obtained information via the data collection processes, it is possible to identify and evaluate conflicts or potential conflicts within the coastal zone. Once identified, ways of resolving the conflicts can be explored (see Chapters 8 and 9).

A valuable aid to the identification and evaluation of conflicts is the use of matrices. Matrices can be used to help identify both conflicts between activities or interests and also impacts of coastal zone activities on various environmental parameters. In the matrix over the page (Figure 9) any of the activities listed can, potentially, interact with the other activities. The specific interactions shown are concerned with the Moray Firth itself and the information shown includes the following:

- Major current conflicts which are indicated in red in Figure 9.
- Minor current conflicts which are indicated in purple in Figure 9.
- Potential major conflicts which are indicated in black in Figure 9.
- Potential minor conflicts which are indicated in blue in Figure 9.
- Beneficial interactions which are indicated in green in Figure 9.

Matrices can therefore be used as a checklist to identify the current and potential future conflicts which could occur within a given coastal zone.[126]

Figure 9: Matrix of Coastal Conflicts within the Moray Firth.



The above matrix is designed as a simple illustrative guide to the conflicts and potential conflicts facing the Moray Firth coastal zone. The detailed information that is simplified within the matrix is discussed below for each user category, as outlined in Chapter 4.

6.2. *Fisheries.*

Many of the issues raised by fisheries activities are related to the fact that this activity is traditional and is felt to be under threat. Fishing sites have often been used for generations and are, therefore, thought to be a traditional right. As a result, conflicts of use occur between fishing and other activities.[126]

6.2.1. The Effects of Fisheries Activities on the Coastal Resource.

6.2.1.1. *Habitat Destruction.*

Modern fishing methods can have a severe impact on benthic communities, particularly the epifauna and long-lived infaunal species.

6.2.1.1.1. Trawling.

Certain groups of non-target invertebrates are affected by trawling, particularly where heavy modern equipment is used. Epifauna and shallow-burrowing infauna, including coelenterates, tube-building annelids and many molluscs are particularly susceptible to damage. In particular, populations of large, long-lived echinoderms and molluscs are very severely affected due to the vulnerability of these animals to physical damage and the long recovery times of the populations. The result of such activity is a change from natural benthic populations to those influenced by man, with a higher proportion of opportunistic species, particularly polychaetes, and fewer of the long-lived, slow-growing groups.[153] It is in areas of high marine interest or where trawling activity takes place close inshore that conflict with benthic communities is likely to occur.[154]

6.2.1.1.2. Dredging.

The general effects of dredge fishing are similar to those noted for trawling, however, in many cases this fishing method will have a greater impact on benthic communities because the areas dredged may frequently be closer inshore in areas of high habitat and species

diversity.[153] Habitat alteration also occurs through the removal of fine material, making muddy sediments more sandy and sandy sediments more gravely.[154] Also the indirect effects of settlement of fine sediment onto adjoining areas can be severe, especially where organisms are not resistant to smothering or where the release of anoxic sediments containing pollutants occurs.[153]

6.2.1.1.3. Pots or Creels.

There is obviously an immediate impact on the benthos when a heavy pot lands on the seabed. This may not be significant in fairly exposed areas where no fragile species are present, but erect and delicate organisms, for example, seafans, bryozoans and sponges, may be damaged or detached by such an impact. Also the use of powerful mechanical pot haulers can cause strings of pots to be dragged along the seabed, particularly in rough sea conditions, affecting a much larger area each time they are laid or retrieved.[154]

No research into the impacts of fishing methods within the Moray Firth has been carried out, except incidental work by the SOAFD Marine Laboratory studying the effectiveness of particular trawling techniques.

Consultations with recreational users of the Moray Firth have shown that fishing activity, particularly by trawlers, has been blamed for destroying breeding and natural habitats for fish within the old three mile limit, and as a result sport fishing in the Moray Firth has deteriorated (see Section 6.9.2.3).

6.2.1.2. *Bait Digging.*

Bait digging is another activity which is receiving increased attention within the coastal zone. Possible problems may occur through damage to fish stocks themselves, particularly if digging is carried out in nursery areas, disturbance to wildlife and the threat to public safety if holes are not backfilled.[126]

6.2.1.3. *Incidental Capture of Non-target Species.*

6.2.1.3.1. Birds.

The accidental capture of seabirds by synthetic gill nets has been documented by Robins (1991, cited in Harding-Hill, 1993). However, the use of monofilament nets is banned in

Scotland, although the amount of illegal use and incidental capture of non-target species is unknown.

Entrapment of birds in salmon 'bagnets' has occurred on the south coast of the Moray Firth off Troup Head.[155] However, this method of fishing is in decline, largely due to economic factors.

Species at greatest risk are predators which either pursue their prey underwater, and / or aggregate in dense foraging groups, of which both types are abundant in the Moray Firth. Those important in European terms include; gannet (*S. bassana*), razorbill (*A. torda*) and shag (*P. aristotelis*), while those of importance in British terms include; scaup (*A. marlia*), common scoter (*M. nigra*), long-tailed duck (*C. hyemalis*) and guillemot (*U. aalge*).

The impact of mortality on Moray Firth seabird populations from accidental capture by inshore and offshore nets has not been assessed.

6.2.1.3.2. Marine Mammals.

Incidental capture of marine mammals in fishing gear is thought to have contributed to the decline in numbers of some species in the North Sea.[156] In this context, monofilament gill nets are of particular concern but as stated above, these are banned in Scotland.

The extent of incidental capture of sea mammals in fishing nets within the Moray Firth is unknown although anecdotal evidence suggests that the harbour porpoise (*P. phocaena*) is the most vulnerable species.[9]

Elsewhere around Britain, bottlenose dolphins (*T. truncatus*) have been reported caught in gillnets, harbour porpoises (*P. phocaena*) in trawls, and grey seals (*H. grypus*) in set fisheries.[157]

6.2.1.3.3. Fish Species.

In addition to target species of fish caught by commercial fishing methods, both non-commercial fish which have no economic value and commercial fish that cannot be landed due to their small size or to quota restrictions are also caught and wastefully discarded.

6.2.1.4. *Navigation.*

There are a number of ways that fishing activities can disrupt safe navigation, for example, the indiscriminate positioning of lobster pots, fixed nets and use of drift nets etc.

6.2.2. The Effects of the Coastal Resource on Fisheries Activities.

6.2.2.1. *Land Claim.*

There has been a long history of land reclamation in the UK, especially in estuaries and along sheltered coasts. While the damaging effects of this have been documented for birds and other types of wildlife, very few studies have considered the implications for fish. The general significance of the loss of productive intertidal and subtidal feeding areas is clear but, if important nursery grounds are affected, the impact may be much greater than might be at first supposed. In addition, patterns of sedimentation and water flow may also be changed.[158] Areas of land claim within the Moray Firth are discussed in Section 6.10.1.1.

6.2.2.2. *Pollution.*

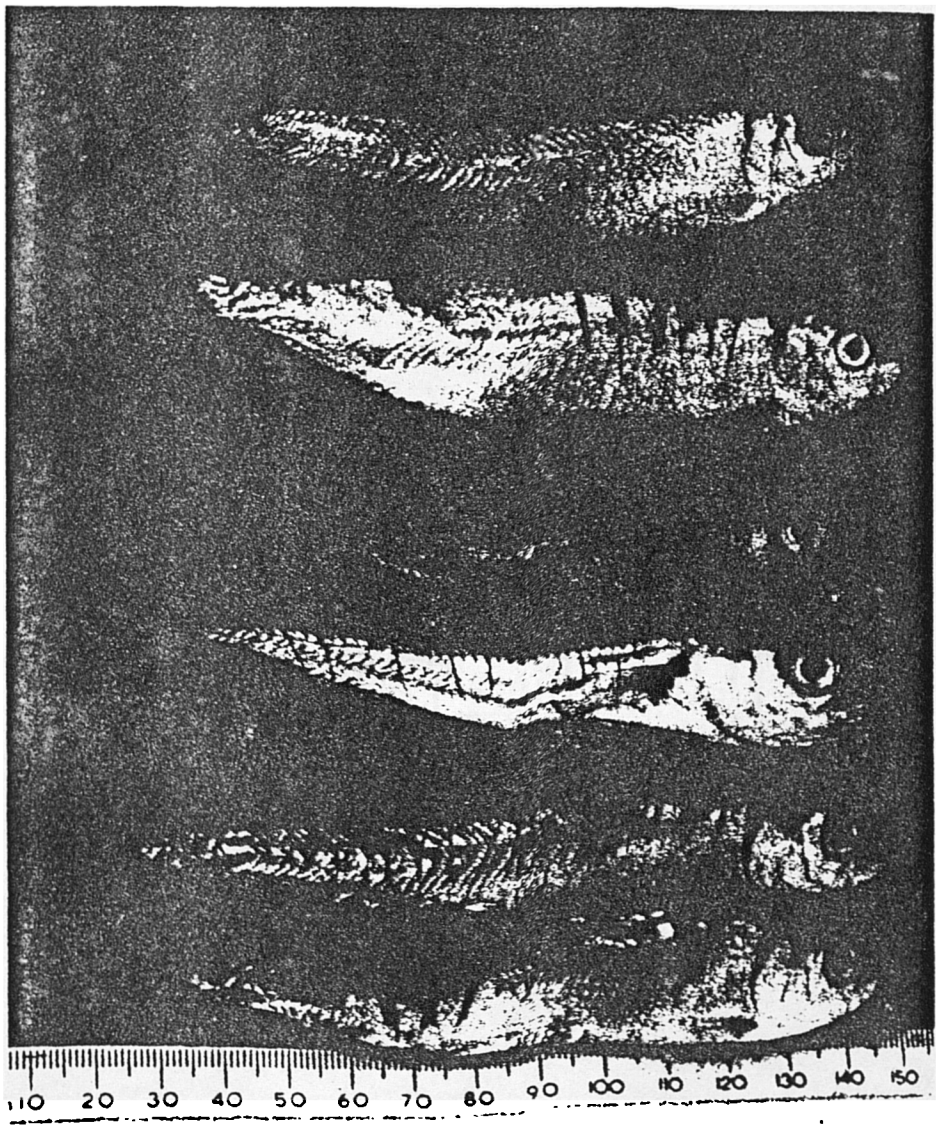
Marine pollution is thought to have little impact upon open sea fisheries in general,[159] and there is little evidence of contamination of food fish. However, the process of bioaccumulation (see Section 6.6, Figure 14) shows that pollutants move through the food chain, and this therefore includes commercial fish species. Having said this, the author has been unable to find any published work on the effects of industrial wastes, sewage effluent or oil spills on the fish stocks of the Moray Firth.

6.2.2.3. *Competition Between Top Predators and Commercial Fisheries.*

The extent of interaction between man and piscivorous animals over fish stocks is notoriously difficult to study, requiring information on such things as; the distribution and movements of fish, feeding effort, fishing effort in time and space and responses of the fishery and predators to changes in fish abundance. However, what can be said is that most of the exploited fish stocks in the Moray Firth are also used as a food supply by marine mammals such as common (*P. vitulina*) and grey seals (*H. grypus*) and bird species such as guillemot (*U. aalge*). Figure 10 over the page shows damage caused to commercial fish species by guillemots (*U. aalge*).

Local fishermen have begun to complain about the seal population of the Moray Firth, stating that it is increasing alarmingly and that seals have been seen 60 miles offshore foraging for fish. Some now believe that a seal cull is very necessary before a state is reached where there are not enough fish to go round.[159]

Figure 10: Examples of Bird Damaged Sprat (*S. Sprattus*) (top), Whiting (*M. merlangus*) (middle) and Herring (*C. harengus*) (bottom) taken in the Beauly Firth.[160]



6.2.2.4. *Hydrocarbon Development.*

Conflicts between the fishing and offshore petroleum industries can arise in a number of different ways. All the conflicts, or potential conflicts, mentioned below occur offshore, however, conflicts can also occur onshore, for example, competition for manpower or service industries.

6.2.2.4.1. Loss of Access to Fishing Grounds.

Offshore oil and gas activities can lead to the loss of access to fishing grounds in a variety of ways. Firstly, exploration and production installations obviously make it impossible to fish in an area where they occupy the whole or major part of the water column. Within the Moray Firth, the Beatrice oil field and installations lie in what was always a productive fishing area for local fishermen, but from which they are now denied access.[159] Even in the case of an installation occupying only a small part of the water column, such as a suspended well-head, sub-sea completion or a single-point mooring, loss of fishing area may nevertheless in practice result, because the prudent trawler skipper will avoid areas with such installations for fear of his gear catching on an installation. Secondly, safety zones around installations, which are normally 500m in radius, lead to the loss of access to fishing grounds because vessels are normally prohibited from entering such zones. Thirdly, pipelines cause some loss of access in practice because vessels engaged in bottom fishing will, if wise, avoid areas where there are pipelines for fear of their gear catching on a pipeline, especially as in the UK it is the general practice not to bury pipelines, except near the coast, in addition, seine-net fishermen find that anchor-hole debris caused by pipe-laying barges cause loss of cod ends, so that effectively half a mile of fishing ground on each side of the pipeline is lost. Pipelines also cause temporary loss of access for all fishing vessels when being laid. Finally, the fouling of the seabed by oil industry debris causes some loss of access to fishing grounds in practice because vessels fishing with bottom gear avoid areas known to be littered with debris in order to avoid the risk of damage to gear and / or the vessel, which can be caused by debris.[161]

6.2.2.4.2. Debris.

Debris from the offshore petroleum industry takes a variety of forms including; empty drums, steel piping, drifting marker buoys, weights, ropes and cables etc. Some debris is dumped from installations and pipe-laying barges, but most is dumped by supply vessels when returning from installations to land. For fishermen debris is a hazard to their fishing gear and to the propellers of their vessels, and sometimes even to the vessels themselves.

Apart from physical damage, fishing time is often lost while repairs are made. However, because of the Code of Practice in existence within the Moray Firth (see Sections 5.9 and 8.3.1), in reality relatively little debris has been discarded.[159]

6.2.2.4.3. Dangers from Installations to Fishing Vessels.

Installations used for the exploration and production of offshore oil and gas obviously represent obstacles to fishing vessels sailing both within and, to and from fishing grounds. At worst there is a risk of collision.

6.2.2.4.4. Obstacles to Fishing Operations.

Apart from the general obstacles already mentioned, such as installations and debris, fishing vessels, particularly trawlers, face a series of particular obstacles to fishing operations from the offshore petroleum industry. These obstacles include; drilling rig anchor systems, which can extend up to 700m beyond the 500m safety zone, suspended well-heads, sub-sea completion systems and pipelines, all on which trawls may catch. In addition, there are supply vessels, pipe-laying barges and platform tugs, all of whose activities may interfere with the operations of fishing vessels.

6.2.2.4.5. Seismic Surveys.

Seismic surveys cause some disturbance to fish and possibly more to their larvae and spawn, but the extent of this disturbance and its consequent impact on fishing operations are not very clear. Within the Moray Firth, seismic operators must carry a fishing liaison officer, nevertheless, fishermen are faced with a degree of inconvenience and disruption, for example fishing obviously can not take place in the path of a vessel conducting seismic surveys.[159]

6.2.2.4.6. Pollution.

Oil pollution, particularly on a large scale, can be a danger to fish stocks, on the healthy state of which fishermen depend for their livelihood. So far pollution from the offshore oil and gas industry in the North Sea appears to have been relatively limited and largely localised, and appears to have had a negligible impact on fish stocks. Nevertheless, fishermen remain concerned about the possibility of large scale spillage.[161]

6.2.2.5. *Aggregate Extraction.*

Many fish need particular substrates on which to spawn. Extraction of aggregates can potentially destroy or damage these areas in a number of ways (see Section 6.4.1.3).

6.2.2.6. *Introduction of Alien Species.*

The introduction of alien species, either accidentally or deliberately, can pose a potentially serious threat that has been clearly identified and should be guarded against. The main areas of concern are that; alien species may disrupt the indigenous fauna through competition or predation, leading to extinction's, that alien races and indigenous species may hybridise leading to alterations and degradation of the natural gene pool and that, exotic parasites and other diseases may also be introduced with almost incalculable negative consequences.[158]

6.3. *Aquaculture.*

The term 'coastal aquaculture' covers various forms and levels of aquaculture operations in coastal lowlands, estuarine and marine waters, involving various species and types of culture systems including; ponds, cages, pens, rafts, long lines and the seabed itself.

Over the past 10 to 15 years, coastal aquaculture of both fin-fish and shellfish species has increased significantly throughout the world, and the coastal waters of Scotland have been no exception. Section 4.2.2 describes the present level of coastal aquaculture development within the Moray Firth coastal zone.

However, during this period of accelerated development, as coastal aquaculture established itself as a major user of the coastal resource, increasing conflicts have come to light.[162] These conflicts involve both the effects of aquaculture development on the coastal resource, that is, other users and the natural environment, and the effects of the coastal resource on aquaculture development. These conflicts are described below.

6.3.1. The Effects of Aquaculture Development on the Coastal Resource.

6.3.1.1. *Pollution.*

Most fish farms discharge their farm wastes into adjacent coastal waters, resulting in a detrimental impact on both the habitat and communities of the seabed and water column.

Detectable changes within the marine environment that have been recorded in the vicinity of aquaculture areas as a result of such discharges include:

- anoxic sediment formation.
- changes in macrofaunal communities.
- acidification of farm sites.
- depletion of oxygen at the seabed.
- growth of pollution tolerant species harmful to the farmed animals.
- phytoplankton blooms.[162]

It is not known what impact the fish farms within the Moray Firth are having upon either the benthos or the water column.[9]

6.3.1.2. *Species Transfer and Introduction.*

Impacts have also arisen from the fact that several species of fin-fish, crustaceans, molluscs and seaweed's have either been transferred, that is, the movement of a species within its present geographical range, or introduced, that is, the movement of a species outside its present geographical range, from one area to another for aquaculture purposes. Such transfer or introduction can alter or impoverish the biodiversity of a marine ecosystem through competition and interbreeding, in addition to possible human health risks and attendant economic impacts.[162]

6.3.1.3. *Chemotherapeutics.*

Problems can also arise from the indiscriminate use of drugs, especially antibiotics to control or prevent fish diseases in coastal fish farms. Research has shown that some native aquatic microbial communities develop antibiotic resistance as a result of such overuse. Braaten & Hektoen (1991, cited in Chua, 1992) listed the following environmental changes associated with the use of chemtherapeutics in aquaculture:

- Quantitative and qualitative changes in the microbial flora.
- Toxic effects on wild living organisms.
- Development of antibacterial resistance in fish pathogens.
- Transfer of antibacterial resistance to human pathogens.

6.3.1.4. *Wildlife.*

There are several ways in which aquaculture developments can come into direct conflict with the wildlife of a marine ecosystem. One example comes from the use of pesticides to control pests and certain predators.[163]

Pesticides in the form of antifouling paints have been used to control biofoulers encrusting facilities such as cages and fish tanks for many years. However, in the past many were indiscriminate in their action, often killing marine creatures which were not fouling organisms. A prime example of this was the use of TBT (tributyl-tin) antifouling paints, which were proved to be toxic to many forms of non-fouling organisms and so banned in the late 1980s, but only after years of use.

Often proactive forms of predator control, which impact upon marine wildlife, are required in order to protect aquaculture operations. Within the Moray Firth the main predators that require controlling are eider ducks (*S. mollissima*) and common (*P. vitulina*) and grey seals (*H. grypus*).[164]

Eider ducks (*S. mollissima*), and to a lesser extent seals, can be prevented from taking farmed animals by the use of barrier netting, however, as is the case in the Moray Firth, stronger action is sometimes deemed necessary. Therefore the shooting of seals is allowed in accordance with the Seal Conservation Act 1970. This Act allows the shooting of any seal seen threatening fish stocks within an area approximately half a mile around gear and cages. The numbers shot within the Moray Firth go unrecorded.[9]

6.3.1.5. *Food Wed.*

The large scale cultivation of filter feeders such as Pacific oysters (*C. gigas*) and mussels (*M. edulis*) can affect marine wildlife by distorting the natural food web of the marine ecosystem. Cultivated species remove phytoplankton and detritus and in so doing compete with other naturally present plankton feeding organisms. The removal rate around an aquaculture site can be quite considerable, with roughly 76-95% of the seston in the natural environment being removed by 50,000 to 60,000 Pacific oysters (*C. gigas*).[162]

The exact impact of such an up take on the species diversity and numbers of individual species of naturally occurring filter feeders is unknown. In the contexts of the Moray Firth, 50,000 to 60,000 Pacific oysters (*C. gigas*) is less than the annual production of Mr R. Davie's shellfish farm within the Cromarty Firth.[52] Therefore the impacts of this shellfish farm acting as a huge sink for the seston within the Cromarty Firth is one area where future research could take place in order to more thoroughly identify conflicts of use.

6.3.1.6. *Visual Intrusion.*

As well as affecting the natural environment, aquaculture development can also be said to have a detrimental impact on landscape quality, although obviously the impact of otherwise similar fish farms is different in different landscapes.[165]

6.3.1.7. *Navigation.*

The principal way aquaculture developments affect the other users of the coastal zone are as simply one more possible hindrance to navigation. Buchanan (1994) stated that there are occasional collisions between both commercial and recreational craft and aquaculture gear below the mean low tide level, however, there are no official reports of such incidents.

In the Moray Firth, none of the yachting / sailing clubs contacted stated that aquaculture developments were a hazard to navigation, however, the Inverness Harbour Trust stated that conflict had occurred between itself and Black Isle Fish Farms over the crossing of navigation channels (see Section 6.3.2.3).

6.3.1.8. *Land Congestion.*

It should also be remembered that most aquaculture developments usually have some form of onshore component, for example, storage, processing or packaging facilities. Such structures represent one more drain on coastal land availability and add to the increasing problem of coastal land congestion.

6.3.2. The Effects of the Coastal Resource on Aquaculture Developments.

6.3.2.1. *Pollution*

Fin-fish and shellfish farmers make a living by supplying good quality products that are fit for human consumption. However, the quality of their product can easily be adversely affected by various types of pollutants that can find their way into coastal waters.

Examples of such pollutants include untreated sewage, which contains human pathogens belonging to such genera as *Salmonella*, *Shigella*, *Campylobacter*, *Vibrio*, *Clostridium* and *Escherichia*. Consumption of aquaculture products infected with these pathogens leads to such diseases as; typhoid fever, cholera, dysentery and Hepatitis-A.[162]

Other pollutants include heavy metals, which may be accumulated by bivalves or fish grown in coastal waters contaminated with industrial wastes. Pathological cases have been reported from the consumption of seafood containing high concentrations of mercury, cadmium, arsenic, lead and chromium.[162] Another health hazard is the consumption of cultured species that are contaminated with relatively high levels of pesticides, which are generally fat-soluble and thus can be easily bioconcentrated in fatty tissues (see Section 6.6), that have entered the marine environment as run off from agricultural land. The risk to aquaculture from oil pollution is also a real threat, as was seen recently when the Braer oil spill in Shetland resulted in the contamination of farmed salmon in offshore sea cages.

Within the Moray Firth one case of pollution affecting aquaculture was reported. This occurred three years ago within the Cromarty Firth, when Mr R. Davie had cause to successfully claim compensation for oil pollution damage to the stock of his shellfish farm.[52]

The above information clearly shows that any hint of possible contamination of a product as a result of pollution makes the product unfit for human consumption, and therefore unfit for sale. Depending on the type and extent of the pollution involved, such a situation could last anything from the short term to indefinitely, either way revenue will be lost and compensation required, which is not an easy or swift process even when the individual polluter responsible is identified.

6.3.2.2. *Predation.*

Predation of fin-fish and shellfish stocks is a problem for all aquaculture operations, and as previously stated the farmers have to take measures that minimise their losses. The majority of the farming operations contacted by questionnaire within the Moray Firth stated that predation had been a problem at some point in time, but that its intensity depended very much on the availability and abundance of natural prey species. For example both Black Isle Fish Farms and Cromarty Trout Co. stated that in previous years they had lost production as a result of seal predation, with the former company suffering losses some years of over 20,000 animals. However, in 1994 both stated that the problem was minimal, probably as a result of the return of herring (*H. harengus*) and sprat (*S. sprattus*) shoals to the Firth.[50, 52]

6.3.2.3. *Navigation.*

Commercial shipping and recreational sailing activities can affect aquaculture developments in one of two ways, both related to possible conflict arising over hindrance to navigation. Firstly, such possible conflict can result in the refusal for a licence to set up an aquaculture development, or secondly, it can prevent expansion of existing developments. This latter type of effect has been at the heart of a conflict within the Moray Firth between the Inverness Harbour Trust and Black Isle Fish Farms.

Over the past two years Black Isle Fish Farms have had plans to expand their fin-fish farming interests into other species, such as halibut (*Hippoglossus vulgaris*). However, their application for a seabed lease from the Crown Estate has faulted owing to objections from the Inverness Harbour Trust who have a remit on navigation within the Inverness Firth. The Trust maintained that as the work boat of the farm would be crossing the Trusts north navigation channel to reach their proposed halibut (*H. vulgaris*) site, it would create a problem to any shipping in the north channel. Dispute arose when Black Isle Fish Farms countered that as 99% of shipping uses the south navigation channel, the remaining 1% were preventing their expansion and therefore restricting growth and employment in the area.[50]

6.3.2.4. *Others.*

Other areas of concern briefly expressed by fin-fish and shellfish farmers within the Moray Firth included worries about; growing congestion of coastal land preventing possible expansion plans, a possible increase in pollution within the Firth, particularly associated with the increasing use of the Cromarty Firth for the mooring of oil rigs and finally, interference in culture activities by statutory and non-statutory nature conservation bodies, with special concerns raised regarding the 'secret' designation of marine Special Conservation Areas (SCAs) which is currently being undertaken by Scottish Natural Heritage (SNH) and the lack of any consultation within this process.[50, 52, 53, 164]

6.4. *Aggregate Extraction.*

Dredging, whether to facilitate navigation or to provide aggregates or fill materials can have a number of possible impacts upon the coastal resource as a whole. These impacts, as well as specific examples occurring in the Moray Firth are discussed below.

6.4.1. The Effects of Aggregate Extraction on the Coastal Resource.

6.4.1.1. *Land Claim and Habitat Destruction.*

The most obvious way that mineral extraction affects the natural environment is via the destruction caused by land claim, be it coastal habitat or subtidal habitat. Offshore, the destruction of subtidal habitats also results in reduced velocities or diverted flows. This can in turn modify physical processes, cause the resuspension of sediments and hence reintroduce contaminants into the water column, or increase turbidity, directly threatening ecological resources, for example, filter feeders, as a result of burial.[166]

6.4.1.2. *Wildlife Disturbance.*

Within the Moray Firth biological and geomorphological issues have been highlighted concerning the potential extraction of aggregates in the offshore area of Spey Bay. The possible impacts causing concern include; the destruction of feeding substrates for birds, smothering of areas of substrate important for feeding birds and disruption of the migratory movements of salmon (*S. salar*) and other fish species through the physical dredging process and disposal of associated fines.[9]

6.4.1.3. *Fisheries.*

The complaints of fishermen cover damage to the seabed and increased turbidity of seawater leading to disturbance of spawning grounds, burial of shellfish beds, disturbance of fish and damage to trawl nets.

6.4.1.4. *Pollution.*

The possible types of pollution that can arise from onshore extraction include; noise pollution from explosions and heavy machinery, oil pollution from equipment and particulate pollution from dust and fines.

Within the Moray Firth, the last reported case of pollution arising from a quarry occurred on the 23rd of September 1991. Complaints about the pollution of a watercourse below Heathfield Quarry to the north of Invergordon lead to Invergordon Sand and Gravel Limited being reported to the Procurator Fiscal and incurring a fine of £1,500.[167]

Concerning offshore extraction, the main worries come from the possibility of the resuspension of pollutants, release of trapped nutrients, noise pollution and oil pollution as a result of collisions at sea.[166]

6.4.2. The Effects of the Coastal Resource on Aggregate Extraction.

There are few if any ways in which aggregate extraction operations already in operation can be hindered by other users of the coastal zone. However, as explained in Section 5.8, there are many constraints on the development of new aggregate extraction operations on both sides of the low water mark. For example, those related to the land planning system, and those related to navigation, fisheries, coastal erosion and communications cables.

6.5. *Hydrocarbons.*

All stages of hydrocarbon exploration and exploitation can have an impact upon the natural environment and other coastal users, that is, the coastal resource. These impacts are discussed below, and where possible actual examples of impacts within the Moray Firth are included.

6.5.1. The Effects of Hydrocarbon Development on the Coastal Resource.

6.5.1.1. *Seismic Surveys.*

The first stage in the development of hydrocarbon resources is that of exploration. Today this is carried out by a series of seismic surveys, however, it is thought that these surveys can have an impact upon marine wildlife. For example, the sounds generated are thought to interfere with the echolocation systems of cetaceans including bottlenose dolphins (*T. truncatus*) and harbour porpoises (*P. phocaena*) which are both present within the Moray Firth. This interference is thought to affect hunting and feeding activities, as well as normal social interaction within a group. Fish species are also at risk from seismic surveys, though here it is not so much the adults that are affected, but the larval and spawn stages.[161]

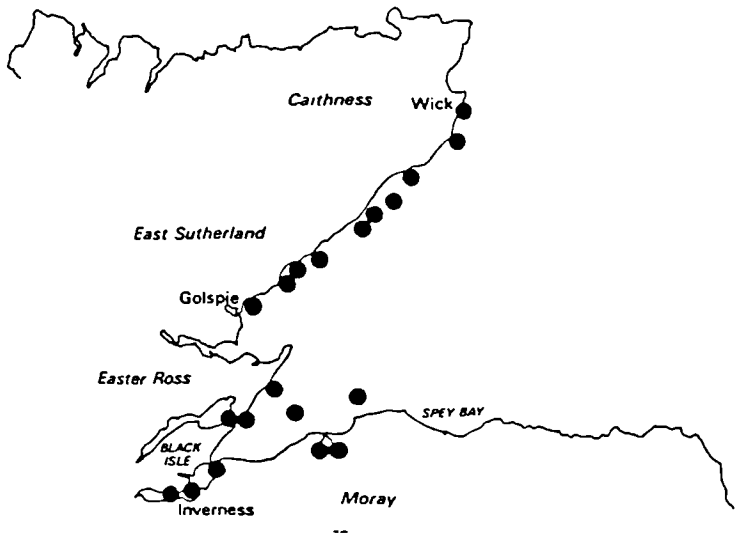
6.5.1.2. *Pollution.*

In the eyes of the public, the most worrying threat arising from hydrocarbon development within the coastal zone is the potential threat of pollution incidents. This perception has been generated over time as a result of media coverage of oil spill incidents, for example, the Torrey Canyon, Exxon Valdez and the Braer incidents.

A review of oil pollution incidents between 1970 and 84 within the inshore waters of the Moray Firth and the Cromarty Firth was carried out by MacLennan (1986).[168]

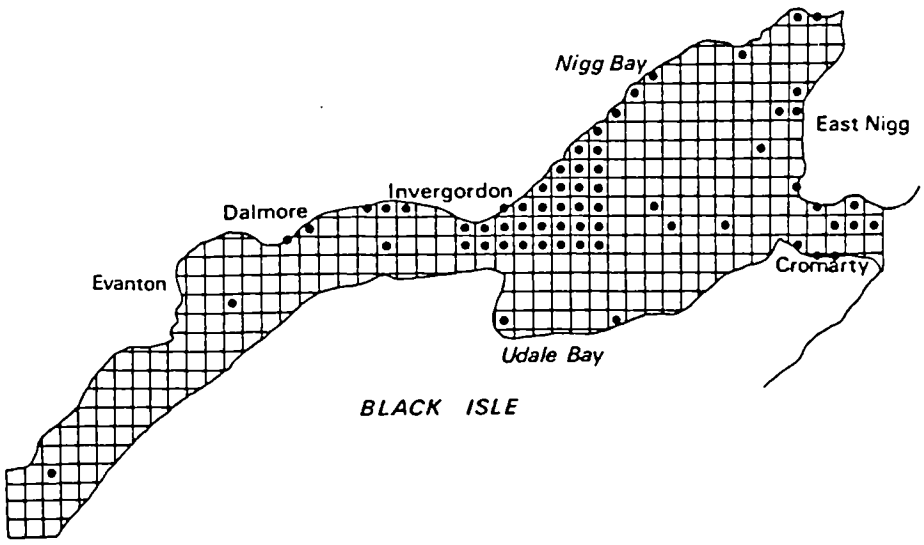
In the ten year period between 1975 and 84, twenty one oil pollution incidents occurred in the inshore Moray Firth between Wick and Spey Bay. These were widely distributed with no single area of concentration, though with a predominance in the north (see Figure 11). More than half the incidents were from unidentified sources. Five of those of known origin related to accidents on both onshore and offshore installations. No extensive spills were noted on the water but in two incidents oil beached over a wide area which may indicate that a substantial volume had been present.

Figure 11: Locations of Oil Spill Incidents within the Inshore Moray Firth, 1976-84.



In the fifteen year period between 1970 and 84, fifty nine confirmed incidents occurred in the Cromarty Firth. All but one occurred in the lower Firth east of Evanton, with a major concentration in the Invergordon area and smaller numbers between Nigg and Cromarty (see Figure 12). Half the incidents were from unidentified sources, while the great majority of those from known sources came from shore based installations such as Nigg Bay Oil Terminal. The quantities of oil involved were uncertain in the majority of incidents, and although no major spills occurred during the period in question, nevertheless some were sizeable. Six exceeded 2 tons, while the largest known was over 30 tons and could have been as high as 80 tons. However, most incidents of known quantity were small, and it would appear that most others were of this order.

Figure 12: Location of Oil Spill Incidents within the Cromarty Firth, 1970-84



An important factor concerning the above oil spills is that dispersants were employed in a number of the incidents in fairly large quantities and occasionally in inappropriate locations close to shore where satisfactory dilution could not occur. In thirteen incidents between 1969 and 74 over 2,500 gallons of dispersant were used. Concern about the use and effectiveness of dispersants in certain situations has resulted in a lower reliance on spraying, especially within the Cromarty Firth, and containment and mechanical treatment has become much more important in contingency planning, particularly where heavy oils are involved.[168]

In more recent years a number of oil spill incidents have occurred, both in the inshore waters of the Moray Firth and within the Cromarty Firth. Some of the more significant incidents are outlined below.

In 1991 small oil balls were washed up on the Shelligoe and Lybster beaches, which on analysis indicated that they originated from the Beatrice oil field off the Caithness coast. As a result, the oil company British Petroleum (BP) cleaned the affected beaches. In a separate incident, 600 gallons of crude oil along with 3,000 gallons of production water were discharged to the sea from the Beatrice Brave Production Platform following the fracture of a pipe on the 20th of November 1991. This time however, the oil was broken up prior to reaching the shore.[167]

On the 20th of January 1991 there was a spillage of about 200 gallons of diesel during a transfer operation aboard the oil rig 'Treasure Prospect'. The rig was sited in the Cromarty Firth between the Nigg Oil Terminal and the town of Cromarty at the time. Most of the oil was contained and the remainder was broken up by the Cromarty Firth Port Authority.[167] While in May 1992 serious oil pollution of the Cromarty Firth occurred about one mile west of Invergordon due to the spillage of an estimated 6,000 gallons of diesel oil from the rig 'Treasure Searcher', Wilrig (UK) Ltd., which was moored in the port area. The spillage was caused when a valve was left open when fuel was being pumped from pontoon tanks to day-tanks on the rig.[169] Finally, what was described as a large quantity of waste oil escaped from a barge when it sank in the Queen's Dock at Invergordon on the 10th of

February 1994. Clean up specialists were called in to contain and remove the oil, however, much escaped.[170]

While no major environmental damage resulted from the above examples, important wildlife resources, and in particular bird populations, have been shown in individual incidents to be extremely vulnerable to relatively small quantities of oil. It is thus important that continued attention is given to the prevention and treatment of oil pollution in the Moray Firth, and that the strict procedures pertaining to oil exploration and production should be maintained.[168]

This is an acknowledgement that there is a potential pollution threat arising from hydrocarbon development within the Moray Firth, irrespective of the high quality of controls and good overall operating record. The potential impacts of oil pollution are dealt with below.

6.5.1.2.1. Subtidal Habitats.

Subtidal areas of the Moray Firth have been impacted locally in the vicinity of oil rigs and other installations operated by the oil industry.[171]

Pre-production seabed ecological surveys in 1977, 1980 and 1981 used extensive replicated sampling from grids of stations over a wide area of the Moray Firth. This permitted a detailed description of the natural seabed community. No trends or anomalies were detected that could be attributed to industrial activity.[172] More recent studies began in 1982 have described the effects of discharges of cuttings contaminated with low toxicity oil-based drilling mud. These post oil-based mud drilling surveys showed marked changes in the structure of the seabed biological community close to the platforms, in particular an expansion of the opportunist polychaete *C. capitata*. At a distance of 65m from the platforms this species had attained its maximum density of 5,430 per m^2. Also, very steep population density gradients were evident, with only a few individuals being found beyond 115m. There was also a slight depression of species diversity beyond the opportunist peak, usually within 250m. Finally, steep hydrocarbon concentration gradients were found, although some elevation was detected beyond the area of biological effects.[173]

These effects were undoubtedly related to discharges of oil-based drilling muds. However, there are a number of possible mechanisms by which these effects may have been produced and they are discussed below.

6.5.1.2.1.1. *Burial.*

The drilling of a single well at Beatrice resulted in the discharge of approximately 1,000 tonnes of cuttings, most of which settled in the vicinity of the platform concerned. Thus beneath, and immediately adjacent to the platform complete burial of the fauna would occur.

6.5.1.2.1.2. *Organic Enrichment.*

The hydrocarbon load of oil-based mud cuttings results in significant organic enrichment of the seabed. As described previously, the faunal response at Beatrice to the input of hydrocarbon rich cuttings includes increased populations of opportunistic species and reduced species diversity, and is thus similar to the general pattern found in other North Sea fields.[174]

Within the organically enriched area hydrocarbon analyses carried out pointed to active biodegradation. Biodegradation was further suggested by redox measurements made during the 1982 survey. These indicated severe oxygen depletion in sediments within 250m of the platforms which was likely to be the result of microbial mineralisation of the oil associated with cuttings.

6.5.1.2.1.3. *Toxicity.*

The Beatrice results showed a clear correlation between high hydrocarbon concentrations and biological effects. This however did not imply a toxic effect since, as described above, the faunal response was consistent with organic enrichment. Therefore, any toxic effects which may have been present could not be separated, and so such effects as there may have been could be concluded as being not more extensive than those of organic enrichment.[173]

Over all it can be said that the effects of the Beatrice drilling discharges have been very localised, with biological effects being most marked close to platforms, comparatively

weak at 250m and undetectable at 750m from the platforms.[173] With the development drilling phase at Beatrice now completed monitoring surveys are continuing in order to follow successional changes and the recovery in the seabed now that the discharge of organically rich cuttings has ceased.[172]

As for other oil installations within the Moray Firth, such as the Nigg Bay Oil Terminal in the Cromarty Firth, survey work carried out has concluded that little petrogenic contamination of the sediments of the Bay has occurred. Levels are similar to those found in 'uncontaminated' benthic sediments in the North Sea.[175]

6.5.1.2.2. Intertidal Habitats.

Habitats particularly vulnerable to oil pollution in the Moray Firth are outlined in the Written Schedules that accompany the maps in the Atlas of Coastal Sites Sensitive to Oil Pollution.[176]

Oil pollution generally does little permanent harm to the plants and animals of exposed rocky shores. However in sheltered bays and estuaries where fine sediments occur, seaweed's and microscopic algae and diatoms are important in the food chain and are also thought to play a key role in stabilising the intertidal sediments. Here oil can interfere with the growth of such algae and diatoms and so lead to a reduction in food supply for birds and fish provided by the rich fauna of worms and shellfish. Saltmarsh has been shown to recover well from single spillage's, but chronic pollution by oily water can cause severe local biological damage and lead to erosion of the marsh concerned.[177]

Within the Moray Firth, between 1975-84 only minor amounts of oil beached on the coast, mainly in the north of the area from Easter Ross to Caithness. Effects on amenity beaches were minor, and though mechanical removal was undertaken by East Sutherland District Council in at least one instance, this was not excessive.

In the Cromarty Firth between 1970-84, some dozen incidents affected mainly small sections of shore, though in one, 14km of lower Firth was oiled. The Local Authority concerned took action to clear oil in this and several other instances where beaching occurred near settlements or harbour structures.

Shore vegetation was oiled only in a narrow band along the tideline and the oil was rapidly dispersed by natural agitation in virtually every case referred to above. Following one incident in the Cromarty Firth in November 1975 however, oil persisted on salt marsh for several weeks, but as expected no detrimental effects on the following years growth were observed.

As stated above, intertidal communities are considered to be able to recover rapidly from individual spills of oil, as well as the detrimental effects of dispersants, and it is doubtful if any area within the Moray Firth as a whole, other than perhaps the immediate vicinity of the port of Invergordon, has suffered a sufficient succession and concentration of spills and dispersant treatments to have had any long-term effects on marine fauna and flora.[168]

6.5.1.2.3. Birds.

The Royal Society for the Protection of Birds (RSPB) Beached Bird Surveys covering the years between 1979-84 appeared to show that there was a steady background of oiled bird casualties on the shores of the Moray Firth. However, out of the twenty one previously mentioned individual oil spill incidents reported within the inshore waters of the Moray Firth, on only five occasions were bird casualties found, and in total slightly less than 500 bird casualties were recorded. Having said this however, given the inaccessibility of large sections of the coast, these numbers may have been only a small fraction of the true total casualties, which could have been as high as several thousand. Also, the prevalence of west to south-westerly winds may also tend to mask the effects of pollution by moving both oil and bird casualties away from the shore.

Out of the five incidents that were known to have affected birds, only one came from a known source, resulting from drilling activity during the early development of the Beatrice oil field.

The RSPB Beached Bird Survey also showed that the great majority of birds affected were auks, mainly guillemot (*U. aalge*) and razorbill (*A. torda*) with some atlantic puffin (*F. arctica*) and black guillemots (*C. grylle*), but other species affected included; eider duck (*S. mollissima*), shag (*P. aristotelis*) and cormorant (*P. carbo*).[168]

Within the Cromarty Firth the oil pollution incidents mentioned previously have had much more of an affect upon bird populations. Twenty of the fifty nine incidents between 1970 and 84 affected birds, almost 6,000 in total, some involving small numbers but several affecting hundreds at a time, with the largest individual number being 3,670. A proportion of bird casualties were only lightly oiled, but over 1,400 were seriously affected and over 200 mortalities were counted in eight separate incidents. However, most mortalities are inevitably under recorded except where large, easily visible birds such as swans (*Cygnus* spp.) are involved. Smaller birds are easily missed, many may crawl into cover to die or are washed offshore, while others are taken by scavengers. Some may also take a considerable time to die. Following a spill in November 1975 in Udale Bay, seventy six dead birds were recorded within two weeks, 117 within three weeks, while oiled geese shot by wildfowlers six weeks after the incident were found to be highly emaciated and would probably have died from the effects of the oil. One young mute swan (*C. olor*) incapacitated by oil finally succumbed to its effects eight weeks after the incident.[168]

As may be expected in the Cromarty Firth, the majority of birds that are oiled are estuarine wildfowl and waders, and in a single incident in November 1975, 31 separate species were affected. In certain incidents, the numbers of some species affected exceeded 1% of the total estimated British population, for example, pink-footed goose (*A. fabalis brachyrhynchus*) in 1972, mute swan (*C. olor*) in 1974 and whooper swan (*C. cygnus*) in 1975.

The bulk of casualties resulted from spills of heavy fuel oil, 5,669 in ten incidents, followed by medium, 217 in five incidents, and light oil, 39 in four incidents. The high proportion of spills involving heavy or medium oils in which birds were affected, 45% and 100% respectively, illustrates the susceptibility of birds to damage by these types of oil.[168] Having said this though, the over riding factors that determine the degree of impact an oil spill will have on bird populations within the Moray Firth as a whole, are not the type or even the amount of oil discharged, but the time of year and the location of the spill.

The distribution of bird concentrations vulnerable to oil pollution varies seasonally, with most of the Moray Firth having a very high vulnerability throughout the year. The

vulnerability of different groups of birds to oil pollution in different months of the year is illustrated in more detail in the Atlas of Nature Conservation Sites in Great Britain Sensitive to Coastal Oil Pollution.[176] Incidents in the following areas would be expected to cause substantial seabird damage:

- The north-east half of the Smith Bank throughout most of the year, particularly April to September.
- Inshore waters along the Caithness coast particularly between April and July, associated with the breeding colonies situated there.
- Inshore waters near the Caithness / Sutherland boarder throughout the year (threat mainly to shags (*P. aristotelis*)).
- Inshore waters off the north-east coast of Grampian throughout the year. Large flocks of flightless auks (juveniles and moulting adults) are present offshore in August and are therefore most vulnerable at this time to an oil pollution incident.[172, 178, 179]

6.5.1.2.4. Marine Mammals.

Each major group of marine mammals confronts oil pollution in its own way. Seals are amphibious, their daily movements between land and sea can expose them repeatedly to areas where spilled oil accumulates. This is especially true of the two seal species present in the Moray Firth, which are coastal residents. Cetaceans on the other hand never cross the boundary between sea and land, and so are at less of a risk of exposure to oil pollution.

Oil however, depending on the form it is in, can cause a suit of physiologic and toxic effects within marine mammals. Vapours, and the light fractions that produce them, irritate and damage tissues, especially the sensitive membranes of eyes, the mouth and the respiratory tract. Oil compounds can also be absorbed into the animals circulatory system, where they attack the liver, nervous system and blood-forming tissues. Therefore, any animal near the site of a fresh spill is at risk from the above effects.[180]

The foamy emulsion known as mousse is less toxic, but nonetheless harmful to those forms of wildlife that utilise fur and feathers to maintain thermal balance. However, because seals and cetaceans use layers of fat under the skin, known as blubber, for insulation purposes, they are less vulnerable to the deinsulating effects of oiling.[181]

One of the main threats arising from an oil spill is that associated with the ingestion of oil by marine mammals. There are a number of conceivable ways in which a marine mammal might consume raw oil, however, the most likely is by consuming prey that are contaminated with oil, or carrying metabolised residues within their tissues.

In such cases, the risk to the animal concerned depends on the prey species involved. For example, planktonic crustacean engulf oil droplets during a spill and retain unmetabolised and metabolised hydrocarbon residues for a week or ten days thereafter. Thus these organisms are a potential source of contamination to consumers for only a short time after a spill. Similarly, marine fish metabolise assimilated hydrocarbons, excrete them fairly quickly, and are thus not a long-term source of contamination. Bioaccumulation of oil residues through plankton and fish is therefore highly unlikely. In contrast, bivalve molluscs have a limited ability to metabolise and excrete oil compounds, they tend to accumulate greater concentrations with time, and through repeated exposure. Molluscs, therefore, pose a lingering threat to those marine mammal species that feed upon them.

Having said this, marine mammals appear to have the liver enzymes required to metabolise and excrete oil compounds. This ability limits the accumulation of residues in body tissues and minimises the probability of residual harm following a spill. However, this is not to say that the capacity of these liver enzymes can not be overwhelmed if an animal ingests enough oil. It should also be remembered that the liver itself is attacked by oil compounds absorbed into the circulatory system, thus reducing the effectiveness of the liver enzymes.[180]

It is clear that oil spills can have a number of impacts upon marine mammals, however, despite this, potential impacts upon marine mammals do not appear to have been considered in several Environmental Assessments or Contingency Plans for oil developments within the Moray Firth.[9]

6.5.1.2.5. Other Users.

The potential impacts of oil pollution on fishing activities are discussed in Section 6.2.2.4.6, and on aquaculture operations in Section 6.3.2.1.

6.5.1.2.6. Other Sources of pollution.

Although accidental oil spill is the main perceived pollution threat from hydrocarbon developments, it is by no means the only one. Other pollution problems include; licensed oil discharge, produced water discharge, the dumping of sewage and garbage over the side of installations and supply vessels, as well as the problem of debris (see Section 6.2.2.4.2).

6.5.1.3. *Land Claim.*

Another impact of hydrocarbon development is land claim, that is, the loss of subtidal and coastal habitats. Offshore habitat is lost as a result of platforms, well heads and pipelines, while onshore, coastal habitats are sacrificed for oil related structures and facilities. Within the Moray Firth an area of intertidal mudflats at Nigg Bay in the Cromarty Firth was claimed for the British Petroleum (BP) Nigg Oil Terminal, pipeline construction yards have been sited on the Morrich More and at Sinclair's Bay, while rig construction yards can be found at Invergordon and Ardersier.

6.5.1.4. *Fisheries.*

The effects of hydrocarbon development upon fisheries activities are discussed in Section 6.2.2.4.

6.5.1.5. *Navigation.*

Offshore petroleum development inevitably results in an increase in shipping traffic within coastal waters. This can result in further congestion of already crowed waters, causing conflicts of use between users, and potentially dangerous situation such as near miss incidents. Within the Moray Firth the potential for a large oil spill as a result of a shipping accident is always present, this is particularly true of heavily used areas such as the Cromarty Firth and routes taken by shipping to and from the Nigg Oil Terminal.

Another navigational problem resulting from hydrocarbon development is the presence of the installations themselves. Installations used for the exploration and production of offshore oil and gas obviously represent a hazard to navigation, though the actual risk of collision is minimal. However, within the Moray Firth, the use of the Cromarty Firth by

the Cromarty Firth Port Authority as a mooring area for rigs has resulted in up to 20 rigs being present within a small area. This situation has a number of impacts, with the most obvious being to navigation, and there have been a number of incidents of collisions within the Firth between ships and rigs, for example, the 'Star Aries' (see Section 6.7.1.2). Consultations with Invergordon sailing club also highlighted potential conflicts that could arise in the future (see Section 6.9.2.1).

6.5.1.6. *Wildlife Disturbance.*

Finally, the presence of the rigs within the Cromarty Firth are thought to disturb local wildlife. Mr A. MacDonald, Secretary of the Dornoch and Cromarty Firths Wildfowlers Association stated that noise from moored rigs within the Cromarty Firth disturbs wildfowl and other bird species (see Section 6.9.2.7), while the mere presence of rigs is thought to have subtle effects on the behaviour of cetaceans and especially the bottlenose dolphins (*T. truncatus*) of the Moray Firth, see Figure 13 below.

Figure 13: Cetaceans and Hydrocarbon Development coming into close contact within the Moray Firth.[182]

6.5.2. The Effects of the Coastal Resource on Hydrocarbon Development.

There appear to be only two ways that hydrocarbon developments can be affected by the coastal resource, one concerning offshore installations and the other onshore facilities.

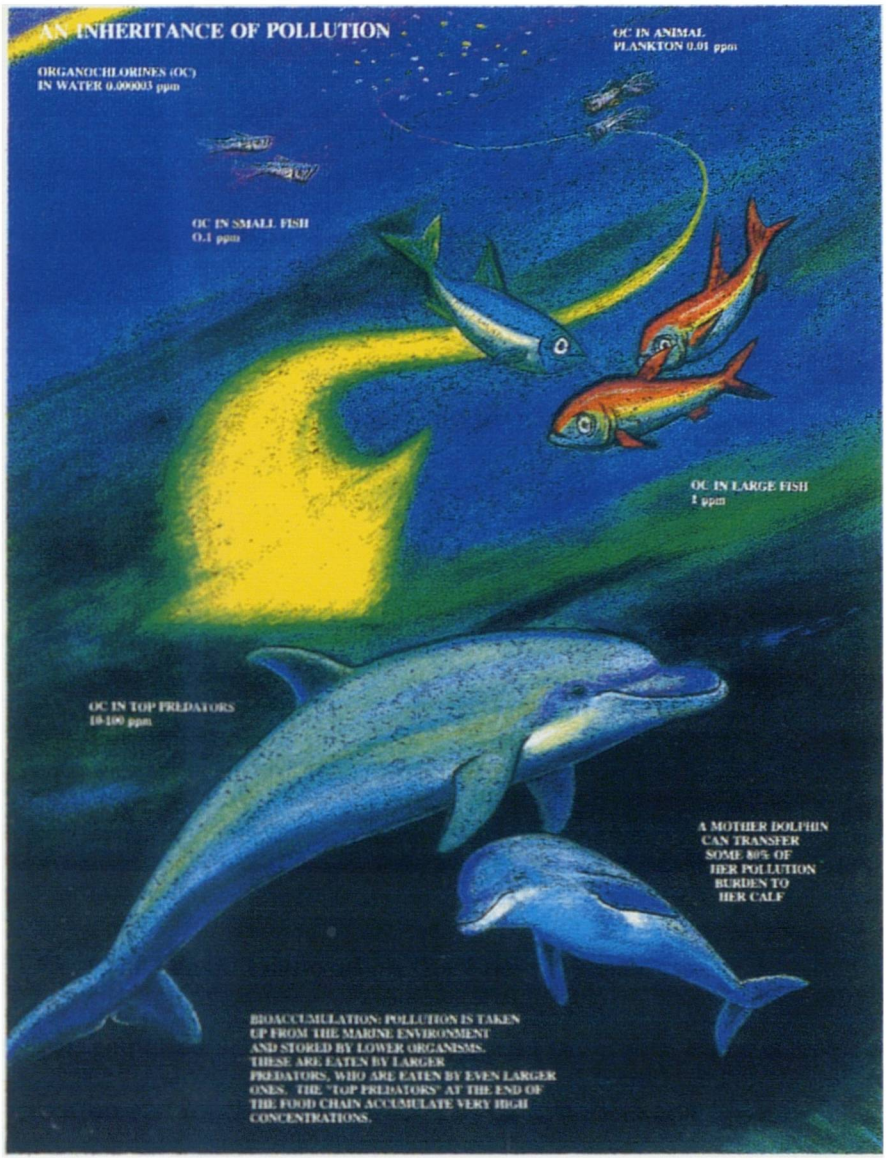
Offshore there is the possible danger of collision with other users, for example commercial vessels, fishing boats or gear, or, floating debris (see Section 6.5.1.5).

Onshore, development of facilities such as oil terminals can be affected by nature conservation issues (see Section 6.8.1), as well as the Town and Country planning system (see Section 5.2.5).

6.6. *Waste Disposal.*

Much of the pollution which presently pours into the sea is not visible, and an attitude in the past of 'out of sight out of mind' was adopted. It was believed that the vast volume of the oceans could dilute any type of waste product. However, this is now known not to be the case, in fact, certain chemicals entering the oceans are not diluted but are actually concentrated by the processes which occur in the water. This is particularly true of persistent, fat-soluble compounds, including many pesticides and polychlorinated biphenyl's (PCBs). These and other chemicals are actually filtered out of the water by microscopic animals which are, in turn, eaten by small fish. The small fish are eaten by predatory fish, these are then eaten by higher predators such as dolphins and, thus, pollution, in increasing amounts, is passed up the food-chain in a process known as bioaccumulation (see Figure 14). As a result, remarkably high concentrations of toxic pollutants can be found in the bodies of marine wildlife.[183]

Figure 14: Bioaccumulation in the Marine Environment.[183]



6.6.1. The Effects of Waste Disposal on the Coastal Resource.

For the effects on; fisheries see Sections 6.2.2.2 and 6.2.2.4.6, aquaculture see Section 6.3.2.1, and recreation and tourism see Sections 6.9.2.2, 6.9.2.5 and 6.9.2.6.

6.6.2. The Effects of the Coastal Resource on Waste Disposal.

Most of the categories of coastal use are involved in one form of waste disposal or another. For the effects of; aquaculture see Sections 6.3.1.1 and 6.3.1.3, hydrocarbon development see Section 6.5.1.2, navigation and communications see Section 6.7.1.3, coastal development see Section 6.10.1.3 and military activities see Section 6.11.1.3.

6.7. *Navigation and Communication.*

Section 4.4.1 describes the key activities of the main ports within the Moray Firth.

6.7.1. The Effects of Navigation & Communications on the Coastal Resource.

6.7.1.1. *Land Claim.*

Port development has led to a large amount of land claim within the coastal zone as a whole. Like onshore developments, this has resulted in loss of important coastal habitat, however, unlike other types of development, port development can also have an affect upon sediment transport and the process of deposition and erosion.

6.7.1.2. *Navigation.*

The main way commercial shipping conflicts with other users is as a result of over crowding of the sea within the coastal zone. As a result of congestion, commercial shipping can conflict directly with recreational users, fishing and military vessels, as well as stationary structures such as aquaculture operations and oil and gas rigs and platforms.

Within the Moray Firth there are a number of examples of such conflicts. Several of the water based recreational groups stated that commercial vessels had to be avoided (see Sections 6.9.2.1, 6.9.2.2 and 6.9.2.3), while collisions between commercial ships and oil rigs have occurred within the Cromarty Firth. The most significant of these occurred on the 21st of January 1991 when a ship, the 'Star Aries', collided with an oil rig in the Cromarty Firth between Evanton Causeway and Dalmore embankment. The ships fuel tanks which contained 120 tonnes of fuel oil were holed. A clean-up company were called in and booms deployed, however, oil reached the shore at Saltburn due to strong tides.[169]

6.7.1.3. *Pollution.*

Such incidents highlight the risk from pollution that commercial shipping poses to the coastal environment. Within the Moray Firth the main risk of pollution comes from the large scale transportation of oil-related products, which greatly increases the potential for accidental spills, the potential impacts of which are discussed in Sections 6.5.1.2. Having

said this however, pollution impacts also arise from such things as bilge washings, or the dumping of garbage over the side.

The everyday functions of a port or harbour can also give rise to the possibility of pollution. For example, leakage of an underground diesel tank at the Esso Oil Terminal within Inverness Harbour resulted in oil pollution of the River Ness estuary in December 1991.[167] Noise and particulate (dust) pollution are also associated with port activities such as the loading and unloading of such materials as; sand and gravel, wheat and maize, cement, fertiliser and potash, all of which are handled by the Cromarty Firth Port Authority at Invergordon (see Table 37, Section 4.4.1).

6.7.1.4. *Wildlife Disturbance.*

Poorly understood, but still of possible significance is the disturbance to wildlife caused by marine traffic. Of particular importance within the Moray Firth are the effects upon the resident group of bottlenose dolphins (*T. truncatus*). It is thought that the possible effects do not just come from the threat of direct collision, but also from more subtle influences upon natural behaviour thought to be caused by the proximity of large commercial vessels, as shown in Figure 15.

Figure 15: One of the Moray Firth Bottlenose Dolphins (*T. Truncatus*) in Close Proximity to a Large Commercial Vessel.[184]

6.7.1.5. *Others.*

A part from the threat from pollution, there are several other ways in which commercial shipping can impact upon the natural environment. For example, the propeller wake of a large vessel can have an impact in two ways, firstly on the shore by causing erosion and damage to fauna and flora, and secondly on the seabed by affecting sediment transportation and deposition.

The other forms of communication, that is road, rail and air, have all resulted in some form of coastal land claim. Onshore many miles of varying coastal habitat have either been covered with tarmac for roads and airport runways, or with loose stones, wood and steel to form railway tracks. As for the marine environment, there are road bridges across the Inverness, Cromarty and Dornoch Firths. Each bride has supporting structures set into the seabed, the construction of which has therefore destroyed individual parts of the Moray Firth seabed.

6.7.2. The Effects of the Coastal Resource on Navigation & Communications.

There are few ways in which the coastal resource is able to affect the activities of ports, commercial shipping and other forms of communication. Because of the traditional right of free navigation, impediments within navigation channels are not allowed and therefore should not arise.[126] However, other forms of craft that use navigation channels can be a hazard to commercial vessels, for example yachts or jet skis.

6.8. *Nature Conservation.*

The purpose of nature conservation, via the system of designations outlined in Section 5.4.8, is to protect valuable and generally non-renewable resources. Therefore, it has to be acknowledged that their management may restrict and constrain other uses and users of the coastal zone. Having said this however, the impacts that other uses and users of the coastal zone have on nature conservation and the natural environment in general far outweigh the effects exerted upon them by nature conservation. The impacts of one upon the other are described below.

6.8.1. The Effects of Nature Conservation on the Coastal Resource.

As stated above, the major way nature conservation affects the other uses of the coastal zone is via the management of designations used to identify areas of local, national and international importance. Such designations are described in Section 5.4.8, and those present within the Moray Firth coastal zone are illustrated on Map 10, Section 4.11.

The different types of nature conservation designations outlined in Section 5.4.8 provide varying degrees of protection, and therefore differing levels of restriction upon development. For example, the actual physical protection for Sites of Special Scientific Interest (SSSIs) is totally in the hands of the owners, and as a result complete protection against damaging action or development cannot be ensured. In contrast to this, National Scenic Areas (NSAs) impact on possible development far more, as a result of stricter protection measures. That is, within NSAs only certain types of development are allowed, and these are laid down on a list of permitted development. However, even the types of development on the list, and several other categories of development, still require consultation with Scottish Natural Heritage (SNH) before being given the go ahead.

6.8.2. The Effects of the Coastal Resource on Nature Conservation.

The effects that other uses and users of the coastal zone have on nature conservation can be best illustrated by outlining their general effects upon the marine environment as a whole, that is the natural environment and the wildlife that live within it.

For the effects of; fisheries see Section 6.2.1, aquaculture see Section 6.3.1, aggregate extraction see Section 6.4.1, hydrocarbon development see Section 6.5.1, waste disposal see Section 6.6.2, navigation and communications see Section 6.7.1, recreation and tourism see Section 6.9.1, coastal development see Section 6.10.1 and military activities see Section 6.11.1.

6.9. *Recreation and Tourism.*

Recreation within the coastal zone, as stated in Section 4.6.1, includes both land based and water based activities.

6.9.1. The Effects of Recreation and Tourism on the Coastal Resource.

6.9.1.1. *Coastal Congestion.*

The greatest threat to the coastal zone is that of over exploitation, often by a multitude of users. Recreation and tourism are increasing rapidly within the coastal zone in general, Walker (1992) predicted that future pressures from tourism and recreation within the coastal zone of Scotland will increase as a result of the changing nature of activities. These changes are likely to be; recreation pursuits spreading over a wider area, the use of an area for longer periods of the year and an increase in the number of people participating in activities on an individual basis.[185] Walker (1992) also predicted that increasing participation in motorised water sports, especially with the advent of newer sports such as jet skiing and sub-aqua diving, and a demand for more and improved facilities, will increase the pressure upon the coastal zone resulting in congestion problems. In turn, congestion may create safety problems.[185] When a coastal zone is heavily used and users have no suitable area allocated to them, conflicts of use may occur such as between jet skiers and bathers. Safety problems may also be experienced at unmanaged access points. For instance, problems commonly occur when there are insufficient slipways along a coastline and jet skiers, sailors and windsurfers all use one access point at the same time.[126]

6.9.1.2. *Habitat Destruction and Wildlife Disturbance.*

Almost every type of recreation can at times, if due care is not taken, cause disturbance to wildlife and its habitat. For example, the noise from jet skies, power boats and flapping sails, the movement of walkers or even enthusiastic bird watchers, can disturb roosting and feeding birds although the long term effects of such disturbance are not yet clear.[126] Within the Moray Firth, wildlife disturbance and habitat destruction has resulted from fire lighting, bicycles, motorbikes and use of other vehicles on vulnerable habitats such as lichen heath, saltmarsh and sand dunes. Horse riding through common tern (*Sterna hirundo*) and wader roosts at high tide has led to bird disturbance at some sites, there is also evidence to suggests that model aircraft and clay-pigeon shooting has also disturbed rafts of seabirds in coastal waters of the Dornoch Firth.

The impact of marine recreational traffic such as speed boats and jet skis, upon marine life, specifically cetaceans, is another area where conflicts are possible. Studies have shown that bottlenose dolphins (*T. truncatus*) react negatively to jet skis and other craft. With the use of fast recreational boat traffic expected to increase in the Moray Firth, Scottish Natural Heritage (SNH) have initiated a Dolphin Awareness Project to help ameliorate the potential for conflict between cetaceans and boat users (see Section 8.3.4).[9]

Wildlife watching from boats is an activity which also has the potential to increase, particularly in the vicinity of areas frequented by dolphins and colonies of cliff-breeding birds. If uncontrolled this could lead to wildlife disturbance.

6.9.1.3. *Education.*

However, in addition to the negative impacts of the pressures recreation and tourism place upon the natural resource, there are several positive aspects. If interpretation is available at key sites, an opportunity exists to increase the appreciation and understanding of the various elements of the resource and the need for its conservation and management. For example, many sports clubs operate 'codes of conduct' and these help educate participants about the importance of the natural environment and the need to manage it sustainably.[126]

6.9.2. The Effects of the Coastal Resource on Recreation and Tourism.

As a result of the diversity of use the coastal zone is put to, there are numerous ways that coastal recreational and tourist activities can be affected by the coastal resource, that is, other coastal users and the natural environment. Below, concerns expressed by clubs and individuals involved in recreational and tourist activities within the Moray Firth, via the consultation process, are considered on an activity by activity basis.

6.9.2.1. *Yachting / Sailing.*

In reply to survey questionnaire's sent out, both Banff Sailing Club and Findochty Water Sports Club indicated that lobster creel buoys were considered by them to be a nuisance as well as a hazard to navigation.[95, 96]

Lossiemouth Sailing Club members stated that congestion of coastal waters was a particular problem along the southern shore of the Moray Firth.[94]

Invergordon Boating Club also stated that lobster creel buoys were a hazard to navigation. They also indicted that oil rigs could prove to be a hazard to navigation while moored within the Cromarty Firth undergoing repairs. The Secretary of the Club stated that to date the above problem had not proved to be serious, however, only because at the moment the area of water involved far exceeds the number of people using it for sailing and other recreational activities.[92] Therefore, it could be reasonably stated that there exists in the Cromarty Firth the potential for increasing future conflict.

Chanorary Sailing Club indicated that a lack of onshore facilities was affecting the activities of their members. Of particular concern was the lack of car parking and storage areas available.[91]

6.9.2.2. *Wind Surfing.*

The majority of other recreational activities that take place in the coastal zone, for example, yachting / sailing, water skiing, speed boating and jet skiing, impact on wind surfing in terms of access, water congestion and pollution, that is, noise and emissions from speed boats and jet skies.

As wind surfing is a sport were contact with the water is quite frequent, water quality and pollution incidents are of concern. Particular problems involve pollution on beaches and in the water from both sewage and shipping and certain industrial processes.

Windsurfing is a developing activity, particularly amongst youngsters and access to the water is essential. Windsurfing requires safe locations and space, both in terms of land access and preparation. Both military activities and nature conservation designations can restrict access to the shore, and therefore limit the opportunities for windsurfing activity.[186]

6.9.2.3. *Sea Angling.*

The Secretary of Kinloss Sea Angling Club state that trawl fishing activity within the old three mile fishing limit had destroyed breeding and natural habitats for fish within the Moray Firth, and as a result sport fishing in the Moray Firth had deteriorated.[110]

The members of the East Sutherland Sea Angling Club also complained that habitat destruction had adversely affected sport fishing within an area four miles offshore of Brora. They also stated that their activities were hindered by both poor access to and from Brora Harbour due to excessive silt build up in the harbour, as well as poorly marked navigation channels. That is, navigation buoys not being illuminated for night passage.[109]

6.9.2.4. *Jet Skiing.*

Of the small number of individual jet skiers that were contacted by questionnaire, the majority stated that their two main problems were, one, a lack of good access sites that were not already overcrowded with other users,[105] and two, restricted access and mobility as a result of military activities between Tain and Portmahomak.[104]

6.9.2.5. *Canoeing.*

The Secretary of the Caithness Kayak Club identified a number of both actual and potential conflicts applicable to canoeists. Of the actual conflicts possibly the most dangerous outlined was the floating out to sea of pipeline bundles from the Wester industrial site within Sinclair's Bay. He stated that this could be extremely hazardous to unwary canoeists. He also stated that care was need to avoid getting in the way of fishing operations, particularly boats going to and from the busy port of Wick.

As with the jet skiers mentioned above, canoeists also complained about restrictions to paddling in the Dornoch Firth due to military activities around Morrich More. Other points of contention include concern over nature conservation designations and the restrictions to access that usually go along with them, as well as the potential for increased lack of access as a result of incoming owners putting up private signs on their land in an attempt to limit access to the shore.[97]

Members of the Inverness Canoe Club also stated that shipping had to be avoided, and also that occasionally speed boats and jet skies cause a disturbance. They also indicated that pollution was a major concern of the members, and that in their opinion its presence within the Moray Firth was on the increase. Once again the question of access proved to be a cause of conflict, this time between the canoeists and the Royal Society for the Protection of Birds (RSPB).[99]

6.9.2.6. *Sub-Aqua.*

Mr D. C. Rogers, the Diving Officer for the Alford Branch of the Scottish Sub-Aqua Club cited a number of issues of concern to divers. The two principal conflicts involve problems caused by pollution and restrictions on access to the shore.

Concerning the problem of pollution he stated that poor water quality occurs in a number of areas along the southern shore of the Moray Firth, including in and around Portsoy Harbour and the area around Portknockie. In fact, he stated that there is a major problem wherever there is an outfall along the coastline which is direct and untreated. Substances he has recorded in the water include; toilet paper, condoms, sanitary towels and human waste. As a result club members have been warned of potential health risks, and advised to consult their doctor upon feeling unwell. Also, as a direct result of fear concerning pollution, most of the club members have been vaccinated against polio.[107]

Restrictions on access to the shore come from two main sources. Firstly as a result of military activity, and secondly as a result of private landowners attempting to remove rights of access to the shore. An example of a prime dive site where this has occurred is Sandend Bay, where a distillery has hampered access to the shore.

Other possible problems mentioned by Mr Rogers include the dangers posed to divers by fishing nets and flotsam and debris present in the water from oil industry and other types of development.[107]

6.9.2.7. *Wildfowling.*

One of the main causes of conflict between wildfowlers and other users of the coastal zone is the disturbance of birds. In his reply to the survey questionnaire, Mr A. MacDonald, Secretary of the Dornoch and Cromarty Firths Wildfowlers Association indicated a number of causes of disturbance. These include noise pollution from trail bikes, which also result in habitat destruction. Other sources of noise pollution include commercial cockle harvesting taking place in areas used by wildfowlers, the generator drone from rigs berthed in the Cromarty Firth and the sound of the jets going to and from the nearby bombing range at Morrich More. Disturbance of this type is known to affect bird flightlines and bird distributions.[88]

Another major conflict pointed out was once again the diminishing access to the shore. Coastal land congestion is mainly to blame, for example; residential housing spread and golf course development, expansion of onshore oil developments, harbour expansions, nature conservation designations and where traditional rights of way have been or have attempted to be blocked off by private land owners.[87]

Having said this, certain access restrictions upon the use of marsh areas and foreshore have proved beneficial to wildfowlers. For example, restrictions imposed by the military have actually secured habitat for bird species, which may have otherwise been destroyed as a result of alternative coastal development.

6.9.2.8. *Golf.*

Over 20% of the golf clubs surveyed stated that the major impact upon them was that of coastal erosion by both the sea and the wind. The majority of the clubs affected had lost either greens or fairways as a result of erosion, and have had to construct protection works in association with their District and Regional Councils in order to safeguard the remainder of their courses.[62, 63, 64, 69, 75, 78, 81, 86]

A number of golf clubs also complained about noise pollution from low flying jets associated with Lossiemouth and Kinloss air fields, as well as the bombing ranges situated around the Moray Firth.[65, 66, 76, 85]

Other more local causes of conflict include crofting on Brora golf course, which is situated on common grazing land. The grazing of cattle and sheep on the course causes increased costs in labour, keeping the course free of droppings and electricity costs for fencing surrounding the greens. The members stated that they receive little support from the landlord in keeping the crofters to the agreed number of animals allowed to graze.[62]

The members of Fraserburgh Golf Club indicated that trail biking activity had become a cause of conflict between themselves and the bikers, the activity is thought to be responsible for eroding the sand dunes adjacent to the course and is severe in some areas. These sand dunes are important to the golfers as they protect the course from the ravages

of wind erosion. The members also stated that attention has been drawn to the problem, but no action has been taken.[85]

On the leased parts of the Royal Dornoch golf course there are several areas designated as Sites of Special Scientific Interest (SSSI). The club is currently negotiating setting up a management plan for the common good of the designated areas since there have been conflicts between the golf club and Scottish Natural Heritage (SNH) with regard to turf cutting. It is hoped that when the management of the area is finalised the club shall be able to resume turf cutting, an activity carried out for over 100 years.[64]

The Secretary of Tarbat Golf Club was the only respondent who volunteered any information concerning beneficial interactions, stating that both temporary and permanent industrial development had increased membership of the golf club.[67]

6.10. *Coastal Development.*

The management of coastal development largely lies in the domain of the town and country planning system, which, as outlined in Section 5.2, is controlled in Scotland by Regional and District Council's. Having said this however, there are a few exceptions to this, for example, some large developments such as ports or marinas may be the subject of Harbour Revision Orders, or an Act of Parliament.

The impacts of coastal development commonly affect many of the varied interests within the coastal zone, while being affected by very few itself, such impacts are discussed below.

6.10.1. The Effects of Coastal Development on the Coastal Resource.

6.10.1.1. *Land Claim.*

Any type of coastal development results in a change in the status of the land concerned, that is, from a natural habitat to an unnatural one. For example, some coastal developments involve the reclamation of intertidal and subtidal land, resulting in the loss of natural habitat. Within the Moray Firth, coastal developments that have resulted in the loss or damage of important habitat as a consequence of land claim include; part of Nigg Bays intertidal mudflats for British Petroleum's (BP) Nigg Oil Terminal, foreshore habitat

for a pipeline construction yards at Morrich More and Sinclair's Bay, and an area of Longman Bay in the Inverness Firth currently used as a waste disposal site.

Such land claim along the foreshore and within the intertidal and subtidal zones not only results in the destruction of natural habitat and the death of the wildlife present, it also results in a change to natural coastal processes such as erosion, deposition and sediment transport. Any change in the patterns of these processes can result in such things as; the silting up of harbours and navigation channels causing disruption to both recreational and commercial vessels, or, new or increased erosion problems elsewhere along the coast, causing damage to the shore and the flora and fauna present.

6.10.1.2. *Visual Intrusion.*

The problem of visual intrusion also needs to be addressed where development is concerned. If poorly planned, sited or designated, a gradual increase in development can slowly destroy the value and scenic beauty of a coast. Increasing levels of both industrial and residential development with associated infrastructure have changed the nature of some coastal landscapes in many parts of the Moray Firth, one example is the continuing industrialisation of the Cromarty Firth.

6.10.1.3. *Pollution.*

Associated with increasing industrial and residential development in the coastal zone are increasing amounts of waste products, often disposed of indirectly into the sea via the river catchment or directly into the marine environment via outfalls. The type of pollutants released include toxic chemicals, sewage and litter.

6.10.1.3.1. Toxic Pollutants.

There are several past and present sources of small amounts of toxic substances discharged or dumped into the Moray Firth.[187] However, despite the small amounts released, heavy metals and organchlorine compounds, small amounts of which are still being discharged into the Firth, are known to accumulate to high levels in the tissues of coastal marine wildlife, especially those of higher predators such as birds and marine mammals. High

accumulation occurs even when environmental levels are low as a result of the process of bioaccumulation (see Section 6.6). The effects on the environment are outlined below.

6.10.1.3.1.1. *Sub-tidal Habitats.*

Benthic habitats and communities can be affected by anything resulting in seabed disturbance, for example, excessive carbon enrichment or the addition of toxins. Impacts may be localised or widespread and have a direct influence on the abundance and distribution of species assemblages.[171]

6.10.1.3.1.2. *Birds.*

High levels of toxic chemicals including heavy metals and polychlorinated biphenyl's (PCBs) within the tissues of adult birds are known to affect the breeding performances of some species of bird. Having said this, no work has been done in the Moray Firth to determine levels of chemical pollutants in bird carcasses or eggs.

However, the former statement gives cause for concern when it is considered that high levels of polychlorinated biphenyl's (PCBs) have been recorded within the Cromarty Firth in the past,[188] which is an important site within the Moray Firth as a whole for overwintering waders and wildfowl.

Also due to the process of bioaccumulation, any toxins present in waders or wildfowl can have implications for bird eating predators such as buzzards (*Buteo buteo*), thus transporting coastal pollution inland via the food chain.

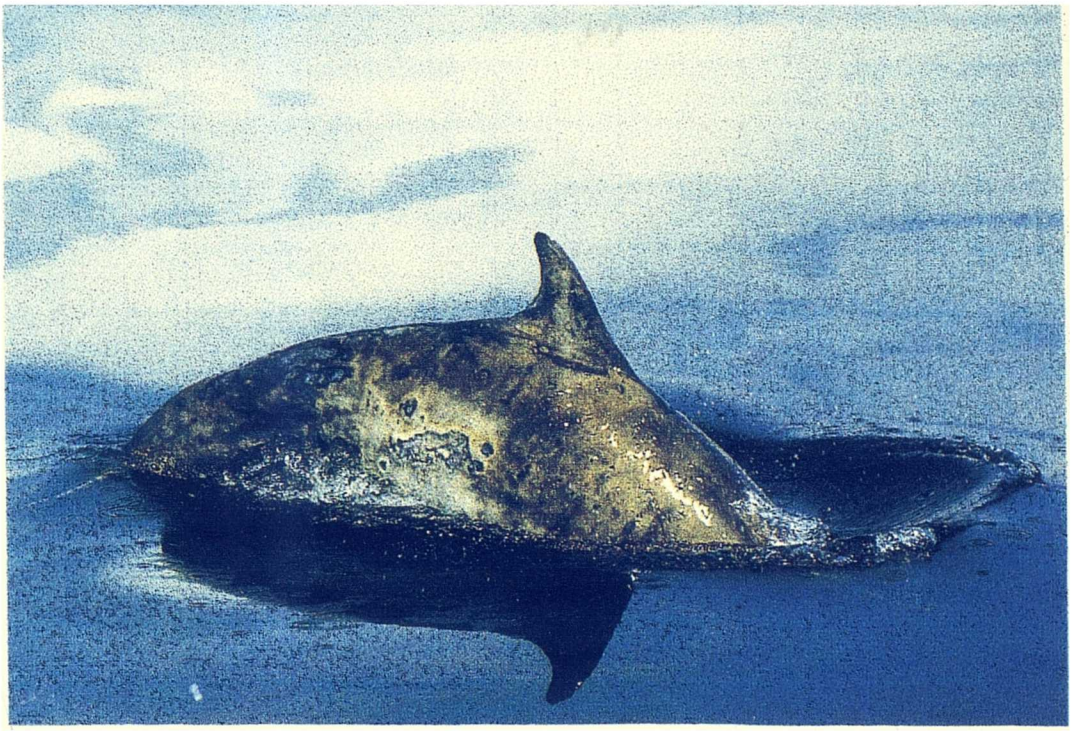
6.10.1.3.1.3. *Marine Mammals.*

Marine mammals have also been found to contain high levels of certain pollutants, in particular persistent chemicals such as organochlorines, which include the insecticide DDT and polychlorinated biphenyl's (PCBs), which are used in industrial processes.

Concern has often been concentrated on these pollutants because they dissolve well in fat and can therefore build up to a high level in the blubber of marine mammals. Because they do not break down easily, organochlorines may also be passed on from generation to generation when hungry pups or calves cause their mothers to draw upon stored fat reserves to produce sufficient milk (see Section 6.6, Figure 14).

Experimental evidence suggests this may affect fecundity and the immune systems of marine mammals such as seals and dolphins. Both the 1988 Phocine Distemper Virus (PDV) outbreak in seals, and a gruesome skin condition in a number of the Moray Firths bottlenose dolphins (*T. truncatus*), which is shown in Figure 16, are thought to have been caused by the disabling of the creatures immune systems as a result of marine pollution contamination.[184]

Figure 16: One of the many Bottlenose Dolphins (*T. truncatus*) from the Moray Firth with a gruesome skin condition.[184]



6.10.1.3.2. Domestic Sewage.

Other types of pollution are more localised, for example the contamination caused by the sewage effluent which is discharged or dumped around much of our coast. However, apart from the high organic loading, sewage effluent can also contains high levels of heavy metals, pesticides, oil and other contaminants. Its effects on the natural environment are outlined below.

6.10.1.3.2.1. *Sub-tidal Habitats.*

Organic material discharged into coastal waters as domestic sewage may create severe oxygen demands in the water and sediment, causing stress and loss of some benthic species, but often increasing the secondary production overall.[189]

6.10.1.3.2.2. *Birds.*

Strong evidence exists to indicate that wildfowl species such as diving ducks, for example eider (*S. mollissima*) and tufted ducks (*A. fuligula*), congregate around sewage outfalls such as the Inverness main drain, feeding on the increased biomass of invertebrates and algae which flourish within the vicinity due to the increased organic loading. However, as already stated, exposure to domestic sewage also increases exposure to toxic chemicals such as heavy metals and pesticides, all of which can be present in sewage.

6.10.1.3.2.3. *Marine Mammals.*

The same can also be said of marine mammals that are to be found within sewage contaminated water. However, one other impact here is the potential for the transfer of pathogens from sewage to marine mammals such as dolphins. No studies have directly assessed whether diseases in marine mammals can be linked with pathogens from sewage discharges. However, it is thought possible that marine mammals are vulnerable to pathogens such as; *Salmonella*, *Psuedomonas*, *Adenoviruses* and *Candida*, which can all occur in high levels in untreated sewage, and can survive in seawater. Such pathogens may be responsible for the skin condition common among the Moray Firth bottlenose dolphins (*T. truncatus*), shown previously in Figure 16.

6.10.1.3.3. Litter.

Litter discharged in the marine environment can be potentially hazardous to wildlife, especially birds and marine mammals through ingestion, entanglement or strangulation.

Coastal stretches of Grampian and Highland Regions have been surveyed in the past for litter pollution and both were found to be approximately 50% 'polluted', 40% of 'moderate' quality and 10% of 'excellent' quality.

6.10.1.3.4. Other Users.

Pollution can also affect the other users of the coastal zone, in particular fish farmers and commercial fishermen. Section 6.2.2.2 covers the effects of pollution on commercial fisheries, while Section 6.3.1.1 is concerned with the affect on aquaculture.

6.10.2. The Effects of the Coastal Resource on Coastal Development.

As stated previously, development above the low water mark is on the whole controlled by Regional and District Councils under the Town and Country Planning Act (Scotland) 1972. When developers apply for planning permission, one of the influencing criteria is the nature conservation designation of the area concerned. If the land is listed under one of the various types of designations, this may result in alterations to the development proposal, or a complete rejection of the application (see Section 6.8.1).

Concerning development that is already in place, out of the 30 questionnaires returned by major companies within the Moray Firth coastal zone, not one complained of any conflicts of any kind with other users of the Firth. However, Mr Jim Wilson of Scottish Rig Repairers did state that other coastal developments had affected his companies activities. The proximity of residential development at Invergordon resulted in his company having to take extra measures to reduce noise and dust emissions from there dock, emissions which he considered to be a normal part of industry.[190]

6.11. *Military Activities.*

Military use of the coast is most commonly in the form of military bases such as naval and air bases, and exercise areas such as target areas, bombing ranges and manoeuvre areas. Specific areas used by the military within the Moray Firth are outlined in Section 4.8.1.

Traditionally the military has absolute supremacy over the areas they use, and as a result, conflicts of use with other users and particularly the natural environment may be considered unavoidable.[126] Exactly because of this supremacy however, those conflicts that do occur are usually very one sided, that is to say, military activities conflicting with the coastal resource as opposed to the coastal resource conflicting with military activity. The conflicts that can occur are described below.

6.11.1. The Effects of Military Activities on the Coastal Resource.

6.11.1.1. *Habitat Destruction.*

One of the most obvious consequences of military activity in the coastal zone is that of habitat destruction. Such destruction affects both the marine and terrestrial environments,

where both bombing, target and exercise areas occur. Within the Moray Firth the use of coastal sites for military activities has created conflicts of use in several sites including Morrich More, west of Kingston (Spey Bay) and Rosehearty. The use of the former after the second world war as a weapons range has resulted in localise bomb, rocket and vehicle damage close to target areas within the site.[191] Having said this, it is believed that in some cases the habitat destruction that has occurred within weapons testing areas has been less than if other forms of development had taken place instead, for example, industrial development or residential spread.

6.11.1.2. *Wildlife Disturbance.*

As well as habitat destruction military activities result in varying degrees of wildlife disturbance. However, the exact effects of explosions within bombing ranges and target areas situated within coastal and inshore areas upon such wildlife as fish, marine mammals and birds are unknown. Within the Moray Firth there are two specific cases of wildlife disturbance that give cause for concern. The first is the effect, especially on the breeding success, of low-flying RAF jets over the gannet (*S. bassana*) colonies of Troup Head.[192] The second comes from the use of a major part of the Moray Firth as a submarine training area. Of particular concern here are the effects of underwater explosions and sonar emissions upon marine mammals, fish and the benthic habitat of the Firth.

6.11.1.3. *Pollution.*

Military activities can also be one more source of possible environmental pollution, and within the Moray Firth this has unfortunately proved to be the case.

The main type of pollution that affects the most number of other users of the Moray Firth is noise pollution, chiefly from low-flying RAF jets going to and from bombing ranges in the area. This was the main complaint made by those user groups contacted by questionnaire, particularly the recreation and tourist users of the Firth. The main locations affected are the Dornoch Firth, Rosehearty and the Kinloss and Lossiemouth areas. In an attempt to combat the problem a grant scheme for installation of noise insulation measures is currently in operation within the worst affected areas.[9]

Noise pollution however, is not the only form of pollution arising as a result of military activities within the Moray Firth. In 1989 RAF Lossiemouth caused the pollution of the Covesea Burn by oil,[193] while in May 1992 a serious incident of oil pollution of the Kinloss Burn estuary in Moray District was investigated by the Highland River Purification Board (HRPB). The pollution was caused by the spillage of 'Avtur' aviation fuel from an overturned oil bowser on a concrete pan with unprotected drains at RAF Kinloss. Airport staff failed to isolate the drain quickly enough, thus allowing the oil to escape to the burn. Under normal circumstances formal action would have been taken by HRPB, however due to the Crown Immunity enjoyed by the Ministry of Defence (MoD) further action was not possible in this case.[169] Figure 17 shows what remedial action had to be taken to avoid pollution of Findhorn Bay.

Figure 17: Containment Measures Following the Oil Pollution of Kinloss Burn.[169]

6.11.1.4. *Other.*

Finally, perhaps the least common or obvious area where conflicts could arise are to do with the risks associated with the storage of ammunition, which can have implications for coastal zone use.[126] For example there is a statutory 500m exclusion zone around all ammunition and weapons storage facilities for safety reasons.

6.11.2. The Effects of the Coastal Resource on Military Activities.

As already stated, due to the absolute supremacy of the military over the areas they use few, if any, activities in the coastal zone have the ability to affect military activities. Therefore the author was unable to find any examples of such conflicts.

Chapter 7: Management Processes Associated with Coastal Zone Management within the Moray Firth Coastal Zone.

7.1. *Introduction.*

The preceding five chapters of this thesis represent the 'information gathering' stage of the management framework developed for coastal zone management (see Figure 1). As such, these chapters fulfil the requirements of the first fundamental principle of the management framework, that is, that any effort to manage the coast must be based on a proper understanding of the processes and characteristics of the coastal zone concerned.

The next stage of the management framework consists of the 'management process', which seeks to fulfil the second fundamental principle of the management framework, which is, that the process of management should be structurally representative of the stakeholders of the coastal zone.

A significant aid to this stage of the management framework was considered to be the establishment of aims and objectives for management of the coastal zone. These can act to draw participants into the management process, as well as generate the realisation of a common purpose between the participants. To this end, outlined over the page are aims and objectives for the management of the Moray Firth coastal zone, based on sound coastal zone management principles. Also identified are management response options, or tasks, designed to achieve or at the very least, contribute towards achieving the set aims and objectives for the co-ordinated management of the Moray Firth coastal zone.

7.2. *Aims & Objectives of Coastal Zone Management in the Moray Firth.*

The prime aim of coastal zone management is to ensure the long-term use of the coastal zone as a resource capable of providing for the social and economic needs of its community, while at the same time securing the cultural and environmental quality of the zone for future generations.

In order to achieve this somewhat open ended goal it is necessary to define what is to be achieved in terms of more measurable shorter term objectives.[8] Such coastal zone management objectives will include:

- A recognition of the critical environmental, economic and social importance of the coastal zone within the Moray Firth.[194]
- The promotion of the sustainable economic use of coastal and marine resources.[195]
- The promotion of the environmentally sensitive use of the coastal zone. For example, the encouragement of development which is in harmony with the sensitive nature of the coast, and / or the restriction of ecologically harmful development within the coastal zone by ensuring that such development is concentrated as much as possible within certain specific areas.[196]
- A recognition that many of the problems encountered in the coastal zone result from conflicts of use between the different coastal users, and therefore efforts must be made to resolve conflicts of use.[197]
- The co-ordination of policies and programmes between neighbouring authorities within the Moray Firth, and the government departments, organisations and agencies responsible for other aspects of 'development' and 'protection' within the coastal zone.
- The development of co-operative coastal information systems, which must be structured so that information obtained is readily applicable to coastal management decision making and planning.
- At all levels of government, programmes should be designed and undertaken to increase public and user awareness and appreciation of the dynamic and sensitive nature of the coastal zone.[194]
- The involvement of the public and users meaningfully in the development and implementation of coastal zone management within the Moray Firth.[195]

7.3. *Management Response Options or Tasks.*

Once the main aims and objectives of coastal zone management for an area have been identified, the next step is to put forward response options or tasks that will, if implemented, achieve or contribute towards achieving those identified aims and objectives. Within the Moray Firth coastal zone, the following tasks outlined below have been identified as contributing towards achieving the stated aims and objectives, and are fully explored below. These tasks are:

- The development of a comprehensive public participation / awareness programme.
- The development of options for institutional arrangements for a co-ordinated approach.

7.4. *Public Participation in Coastal Zone Management.*

Public participation is an essential element in the process of development, administration and implementation of a management framework for coastal zone management. Through public involvement in the management framework, public needs and aspirations can be reflected in management decisions concerning the coastal zone, and public support for the management framework can be generated.[198]

The meaningfulness of public participation can be described in terms of the following ladder in Figure 18, from high involvement to non-participation.

Figure 18: Levels of Public Participation.[199]

The two lowest levels, manipulation and therapy, describe levels of non-participation. The objective of this type of 'public participation' is not to enable people to be actually involved in the process of developing coastal zone management, but to enable power holders to influence the views of the participants. Informing, consultation and placation are higher levels of public participation. In these cases the publics views are heard but there is no assurance they will be heeded.

Further up the ladder are levels of public participation involving increasing degrees of decision making power. The partnership level allows the public to negotiate and engage in trade-offs with traditional power holders. This level of public participation is characterised by two way communication between the public and planners and managers. At the top most level are delegated power and citizen control. In these cases the public has the majority of the decision making powers, or full managerial power.[199]

The question which such a discussion of the levels of public participation raises with regard to this thesis is, which level or levels are appropriate for the development, administration and implementation of coastal zone management within the Moray Firth ?

It is the opinion of the author that the partnership level of public participation is the only level that would allow the management framework for coastal zone management developed for this thesis to be applied within the Moray Firth coastal zone with the full backing of the different users of the Moray Firth.

7.4.1. Identifying the 'Public' for Participation.

The critical first step of any public participation programme is the explicit identification of the 'public'.[200] Today, society is increasingly complex and pluralistic, a collection of interest groups and individuals competing for resources and power. It is certain then, that any management framework for coastal zone management will find itself dealing not with a unitary public but rather with a set of publics.[201]

Chapter 4 identifies the different users of the Moray Firth coastal zone, for example, recreational users, commercial and industrial users, military users and the general population that live within settlements sited around the Moray Firth coastline. The following chapter, Chapter 5, then went on to identify those organisations, agencies and levels of government involved in the existing planning and management regime of the Moray Firth. Taken as a whole, these individuals, groups, organisations and levels of government represent what can be termed the 'stakeholders' within the Moray Firth coastal zone. It is these stakeholders that are the 'public' in terms of coastal zone management within the Moray Firth, and it is they that have to be identified and brought into the management process. Therefore, the further use of the terms 'public' or 'publics', refers chiefly to the stakeholders of a particular coastal area.

Outlined over the page are five methods for identifying the public; self identification, snowballing, direct research, issue analysis and substitute advocacy.

7.4.1.1. *Self Identification.*

A number of organisations or individuals will recognise on their own that coastal zone management may result in the implementation of policies and plans which will directly affect their interests. This public will not await identification, but instead will initiate the contact themselves.[200]

The best techniques for alerting these self identified publics are those that are the most conventional, that is, mass mailings, leaflets, newsletters or press releases. Aside from these standard practices, little initiative has to be taken to determine the self identified public.

7.4.1.2. *Snowballing.*

Another method of identifying relevant publics builds upon the existing stock of self identified publics, as well as public agencies familiar with coastal zone related issues such as Scottish Natural Heritage (SNH) and the Scottish Office Agriculture and Fisheries Department (SOAFD).

In snowballing, representatives of self identified interest groups and public agencies are asked for contact names that can be added to the inventory of participating publics. This technique is also referred to as third party identification or the reputational approach. All three terms essentially describe the same process, that is, when one contact leads to the identification of one or more new contacts.[200]

This method of identifying new contacts was utilised to help identify the users of the Moray Firth (see Chapter 4). Each questionnaire sent out to previously identified users (see Appendix 2) asked them to identify further users in their particular field, for example, previously identified fish farmers were asked to provide the contact names and addresses of any other fish farmers they were aware of within the Moray Firth coastal zone.

7.4.1.3. *Directory Approach.*

Several specialised organisational directories are available which should be carefully reviewed when searching for publics. Those used to help identify the users of the Moray

Firth included the; Directory of British Associations and Associations in Ireland, Directory of European Industrial and Trade Associations, Directory of European Sports Organisations and Sell's Scottish Directory.

However, directories must be used carefully, they are best employed in identifying publics which are most concerned with a specific issue or problem, or within a certain geographic area.[200]

7.4.1.4. *Issue Analysis.*

Issues raised by coastal zone management form another basis for identifying publics. For example, each of the following issues concerned with coastal zone management, that is, offshore oil exploration and extraction, sea level rise and coastal habitat degradation, suggest a certain type of public and usually a representative organisation which is then used in compiling a mailing or contact list.[200]

7.4.1.5. *Substitute Advocacy.*

Even with the most open and aggressive participation effort, the management framework for coastal zone management will only rarely be able to create equal access to its decision making process.

Occasionally, individual or an organisation representation is either too unstable, invisible or inarticulate to be taken on board the management process. Under such circumstances, it may be necessary to designate other willing individuals, groups, or a paid consultant to serve as advocate for the interests of the missing or underrepresented individuals or groups.

However, this method should only be used when the values of certain individuals or groups are deemed essential to the decisions at stake or missing or underrepresented in previous dialogues, and in both cases are able to be substantially and faithfully presented by a substitute advocate.[200]

It is evident that the methods suggested above for identifying the public could be undertaken sequentially as part of a management framework for coastal zone management, one built upon the other. In some areas there may be sufficient self identified participants

at the outset, with no need to engage in the other methods described. However, in others, a system combining techniques might have to be used.[200]

7.4.2. Objectives of Public Participation.

Public participation facilitates a number of specific objectives which are of importance to coastal zone management. The seven objectives listed below may be conceived approximately as points on a scale, for example, the first objective cited, the safety valve function, is probably the most modest achievement of public participation. It requires only the simplest kind of public interaction within the management framework for coastal zone management, while the last objective, conflict resolution, is a much more complicated task.[201]

7.4.2.1. *Safety Valve Function.*

When dealing with issues that affect the coastal zone, with its large number of uses and users, it is evident that no decision will benefit or please everyone. If, however, the framework for management employed provides the public with opportunities to register complaints, however unfounded they may seem, or in fact may be, it can relieve pressures which have arisen between competing interests within the coastal zone.[202]

Public meetings often include presentations which do not introduce new information, explanations, or even points of view, but simply allow their authors to declare their irritation and frustration. This is by no means a trivial function, on the contrary, since it reduces the probability of alienating individuals and groups from the ongoing, or proposed process of management, the safety valve function of public participation is highly useful.[201]

7.4.2.2. *Education.*

Often, the public has little or faulty knowledge of the ecological and economic value of coastal areas. Coastal zone management should foster understanding of the complexity and importance of physical and biological systems within the coastal zone, because such understanding is a prerequisite to informed and meaningful discussion concerning the management of the coastal zone.[203]

Within the Moray Firth, education materials and resources are currently being produced in a drive to raise awareness concerning the importance of the Moray Firth and the need for its wise use.[204] Resources already developed in response to requests by teachers and other environmental educators include; a slide pack including information on both the natural heritage interest and the uses of the Firth, a source book of sites around the Firth that are suitable for field work and a Moray Firth poster including teacher notes. All these resources aim to help children as well as adults to:

- Understand more about the different landscapes, ecosystems and human uses of the Moray Firth and the interactions that occur between these elements.
- Recognise the need for balance between human activities and the natural environment in the Moray Firth area.
- Develop a sense of wonder and responsibility for the Firth.[205]

Other attempts to increase public awareness and education concerning the Moray Firth include an exhibition titled 'Under the Sea', which was recently held at Inverness Museum. It was aimed at illustrating how technology is used to understand the underwater natural heritage of the Moray Firth with an emphasis on interactive and locally relevant exhibits. Part of this display is now visiting other venues around the Firth.[204]

7.4.2.3. *Identification of the Publics Problems, Values and Needs.*

One of the principal purposes of public participation in coastal zone management is the expression of public doubts, needs and aspirations. Beyond the simple matter of equity is the more pragmatic consideration that a management framework which does not consider or understand the publics attitudes and needs is almost certain to arouse hostility and opposition.[201]

For example, research carried out to identify the different uses and users of the Moray Firth (see Chapter 4), initially highlighted hostility to the concept of coastal zone management. For example, Mr Bill Bruce, Secretary of the Caithness Kayak Club stated that he was reluctant to return the user questionnaires sent to him (see Appendix 2) from –"a suspicion that any information freely given would be used to impose management schemes for

coastal areas that had not needed them in the past, nor would in the foreseeable future."[97] The doubts expressed by Mr Bruce were then taken on board and used to help develop the subsequent initial zoning scheme for the Moray Firth (see Chapter 9). When sent to Mr Bruce, he stated that the initial zoning scheme –"had been developed with care, sensitivity to the needs of sea canoeists and on a practical basis", and therefore he endorsed the views outlined in the initial zoning scheme.[206] This is a clear example of how listening to the doubts and views of the public, via public participation exercises, can enlist support for the concept of coastal zone management and avoid unnecessary hostility and opposition.

7.4.2.4. *Generation of New Ideas.*

One of the most useful functions of public participation is the generation of new ideas. It is not likely that any single group, statutory or not, can achieve a monopoly of relevant ideas for the larger society in which it exists. The public, or in a given case some segments of it, may possess extremely valuable information and opinions. As part of a management framework for coastal zone management, public participation may identify or develop:

- Previously unrecognised sources of data.
- New policy and implementation alternatives.
- Previously unanticipated policy impacts.
- Means of ameliorating policies and plans undesirable consequences.
- Previously unknown negotiation or trade-off positions concerning coastal zone issues of concern such as the resolution of conflicts of use.[201]

Therefore, public participation should be viewed as a two way means of information exchange.[199] That is, not just the public being provided with information relevant to their coastal zone, but the public providing information and ideas relevant to the management of their coastal zone.

7.4.2.5. *Review and Comment on Proposed Policies and Plans.*

The establishment of processes to review component elements of coastal zone management policies and plans, that is, management decisions, are particularly useful to the overall process of coastal zone management for a number of reasons. Review procedures can warn of impending conflicts and public opposition to coastal zone management policies and plans. Through such public participation, policies and plans which are at significant

odds to public feeling can be revised or abandoned before large amounts of time and effort are committed to their development.[201]

Because of the continuous relationship characteristic of review procedures, such procedures foster increased information feedback from the public into the management framework for coastal zone management. This is a major asset for several reasons; regular feedback shortens public reaction time and thereby often prevents minor issues from becoming full-blown crises, encouraging ongoing feedback indicates a commitment on the part of the management framework to public participation and consolidates public support for the framework, and finally, regular feedback facilitates and sustains, as more sporadic public meetings cannot do, the two way information flow which is crucial to democratic decision making.[199]

7.4.2.6. *Evaluation of Alternatives.*

All planning and management involves the formulation and consideration of alternatives, and the choice, according to some criteria, of a best from among them. These alternatives and the choice among them are never simply matters of fact. Cultural, group and individual values inevitably influence the range of alternatives which will be conceived and the principles according to which a selection of the optimum is made.

Although the evaluation of alternatives is a complicated matter under any circumstances, in decisions affecting the coastal zone, where many of the environmental and social values are intangible or extremely difficult to quantify, the problem is heightened and increasingly subject to debate. If the public has not been involved in the development of the alternatives, decision making will suffer in terms of efficiency and validity. It is unlikely that the public will be able to understand the implications of the various alternatives, and therefore will be able to treat them only in a superficial manner or with general hostility.

It is, therefore, essential that the public be engaged in the process of constructing and reacting to alternatives from the outset. In practice, this means that the requirements of public participation discussed above must be satisfied by the management framework for coastal zone management before the stage of formal alternatives evaluation is reached. In this sense, evaluation of alternatives depends on the five aspects of public participation

which precede it in terms of difficulty and complexity, and it is prerequisite to the level of public participation which follows it, conflict anticipation and resolution.[201]

7.4.2.7. *Conflict Anticipation and Resolution.*

As stated in Section 9.2, it is virtually impossible to discover a single, unanimous public.[200] Typically therefore, each decision reached or alternative offered will have both public partisans and critics. Public participation provides a means for segments of the public to present conflicting views and also to air and negotiate the competing aims and interests as they perceive them. Accommodations via negotiation are more likely to be reached between conflicting interest groups if these interest groups have had an adequate opportunity to be heard, also under these conditions, the accommodations negotiated are more likely to receive general support.

Therefore, the identification of actual and potential conflicts is one of the most important contributions the public can provide to the management framework for coastal zone management. A coastal zone management framework may be seriously impaired if it is confined to issues and problems of the present. Public meetings or review procedures may be able to raise points which reveal developing or incipient areas of public concern. Thus, public participation, in addition to raising and resolving immediate conflicts, may enable the process of coastal zone management to forecast future problems and to devise strategies for forestalling or disposing of these problems before they become critical.[201]

7.4.3. Public Participation Mechanisms.

Any effective public participation mechanism must allow for two fundamental elements, education of the public and a response to the public.[207] In order to insure intelligent, objective participation by the public, the public must understand the nature of the problem, all the possible solutions and the costs of these solutions. Mean while, the management framework must be capable of responding to the inputs of the public, and allow for that input to have an impact.[199] A number of participation mechanisms are discussed below.

7.4.3.1. *Public Meetings.*

Public meetings, though the most prevalent type of public participation in the planning process due to their frequent legal requirement, for example the use of Local Plan

Enquiries as part of the town and country planning system (see Chapter 5), are not necessarily the best vehicle for effective public participation. The major problem associated with public meetings is the inability of the public to insure that they have had an impact on the management process. If the public feel that they have had no impact through the meeting process, frustration builds. Such frustration may lead to civil suits, court injunctions and delays in policy and plan implementation.[199]

Within the Moray Firth, the Scottish Wildlife Trust Inner Firth Environmental Forum hold an annual series of open meetings entitled 'Future Firths' which aim to provide an open forum for debating the present and future value of the Firth for agencies, businesses and communities. A series of recommendations from these meetings have been made which include the proposal that a partnership should be formed of those organisations and bodies interested in the future of the Moray Firth to promote integrated management.[204]

7.4.3.2. *Workshops.*

Workshops are excellent teaching mechanisms that provide the interested public with the tools to consider and debate the future of their coastal areas, as well as providing the management framework with often previously unknown data.[207]

If workshops are being utilised to encourage general participation, it is advisable that they are planned around a particular project, issue or problem. This provides the participants with 'something to get their teeth into'. It will also provide a model for holding future workshops, where solving a particular problem may be an imperative[199]

Within the Moray Firth, the second stage of SNH's Moray Firth Project, following the publication of the Moray Firth Review, was the initiation of discussion on the future of the Moray Firth among a range of interested parties through a workshop hosted by SNH in November 1992. The workshop gave a range of organisations an opportunity to consider and debate the future use of the Moray Firth as a valued natural resource, exploring the practicalities and priorities of acceptable management mechanisms. The conclusions included; the recognition of a need to raise awareness of the areas interest and importance, the need for a more co-ordinated and integrated approach to management of the Firth, the

importance of involving local communities in management, an investigation into the opportunities existing in various forms of co-ordinated data management and the encouragement of employment opportunities that are not damaging to the environment.[204]

7.4.3.3. *Survey Techniques.*

A variety of survey techniques have been developed which allow the identification of the attitudes and preferences of the public to issues of concern. These techniques range from free unstructured interviews, to more structure interviews utilising checklists, to the use of specifically designed questionnaires.[207]

It should be emphasised that survey research is a specialised procedure, nonetheless, it is one which can be valuable to the process of coastal zone management, particularly where the conventional participatory mechanisms are not possible to implement or have failed, or where especially detailed and accurate information is needed.[201]

Several different types of survey questionnaires were designed and used in public participation exercises carried out as part of this study. Examples of these questionnaires can be found in Appendices 2, 3 and 4.

7.4.3.4. *Decision Making Forums.*

Finally, a useful mechanism for obtaining the publics viewpoints is via the establishment of a decision making forum. The motivation for these is often a need to supplement frequently awkward and insufficiently representative public meetings.[201] Typically there are two rationales used in selecting forum members. One is to select a cross section of the population to create a structurally representative microcosm of the community. The other is to select members on the basis of their expertise in specific fields.[199]

The main advantage of decision making forums over the other types of public participation mechanisms is the provision of two way communication at regular meeting, and the continuity of interaction that this brings.[201]

Further investigation of the role of public participation, and particularly decision making forums, with regard to the development of institutional arrangements for coastal zone management is discussed over the page.

7.5. *Development of Institutional Arrangements for Coastal Zone Management.*

In many coastal nations a sectorial, or 'ad hoc', approach has evolved to manage the specific resources and activities of the coastal zone in isolation from one another. Such an approach however, fails to take into account the fact that the individual resources and activities of the coastal zone do not operate in isolation, but form part of an intricate web of ecological processes and human interactions.

Within the UK such a sectoral approach is currently in place, therefore there is no shortage of government departments and agencies with a mandate within the coastal zone (see Chapter 5). As a result of this, a broad range of institutional arrangements, policy instruments and management strategies exist to help allocate coastal resources among often competing and conflicting interests. However, the problem is that the coastal zone is the shared responsibility of many departments, agencies and interests, but the sole responsibility of none. Further, while many separate laws and regulations concerning activities in coastal areas can be identified, there are often no explicit management policies for coastal resources in existence at the national level.[208]

In contrast to the fragmented pattern to coastal resource management that develops as a direct result of a sectoral approach, one of the principal objectives of coastal zone management is to obtain a more co-ordinated approach to the management of the coastal zone. As part of a management framework for coastal zone management, a need therefore exists for inter-sectoral collaboration and co-operation. It is the opinion of the author that the required level of collaboration and co-ordination can be principally achieved via the development of appropriate institutional arrangements that would operate in a co-ordinated and integrative fashion.

There are two main ways to address the matter of development of institutional arrangements with regard to the management of the coastal zone. Coastal nations may make what is termed an 'organisational response', whereby they act within their prevailing legal and organisational frameworks to improve the workings of their coastal resource

management systems, through the development of new planning and management techniques and tools. Alternatively, they can make what is termed a 'legislative response', whereby they redesign the existing coastal resource management system, through changing laws and the structure and responsibilities of management agencies.

The following section examines cases where both organisational and legislative responses have been used by selected coastal nations to develop institutional arrangements for coastal zone management. Inevitably such a review must be brief and selective, however, it does indicate some important trends in the administration of the coast in other countries, many of which face, or have faced, similar problems to those that face the UK.[209]

7.5.1. Institutional Arrangements Developed in other Coastal Nations.

7.5.1.1. *Institutional Arrangements in the USA.*

Institutional arrangements in the USA were established by the Coastal Zone Management Act of 1972 and by the Coastal Zone Management Reauthorisation Act of 1985.[210]

In terms of administrative structures and responsibilities the underlying principle of these Acts is that the State has local control but must stay within national policy concerning the coastal zone. The Federal government in turn has to ensure that Federal activities directly effecting the coastal zone are consistent with State programmes, and will avoid inconsistencies with State coastal zone management policies. However, despite these Acts there has never been a Federal prescription with regard to how coastal States should proceed in establishing their programmes and management structures institutionally, and as a result a range of development options have arisen.[209]

At one end of the 'institutional arrangements spectrum' is the Californian model. In 1972, California created a new 'super agency', the Californian Coastal Commission (CCC) which was endowed with sweeping comprehensive authority not only to plan, but also to regulate development. In short, the Californian model represents a legislative response to the problems of fragmentation and dispersion of land and water management authority. Other States such as North Carolina and Tennessee have also followed this approach.

At the other end of the spectrum is an approach which relies on existing agencies and authorities and improved policy development and co-ordination to achieve coastal management objectives, that is, an organisational response. In the USA this approach was termed 'networking', and several States have followed this approach.[210]

The networking concept was originally conceived by the Federal Office of Coastal Zone Management (OCZM) as a way for States which already had substantial control over coastal activities and areas to bind their coastal policies into the existing network of management controls. That is, States could meet Federal requirements for programme approval by interconnecting existing State statutes and policies. More States could thus pursue programme approval by demonstrating that they had general State authority over resources and uses identified in the Federal Act of 1972 and Reauthorisation of 1985.

The present operating definition of networking, used by the Office of Coastal Resources Management (OCRM), OCZM's successor, suggests a programme characterised by the separation of policy, planning and enforcement functions and authorities among State agencies or between State and Local governments. A networked programme has the following attributes:

- The programme emphasises making pre-existing authorities work better and in a more co-ordinated manner.
- The designated lead agency has broad policy formulation and co-ordination responsibilities and a horizontal orientation, that is, is concerned with cross-cutting issues and functions in contrast to a vertically oriented agency organised around a comparatively narrow mission.
- The lead agency tends to be an Executive Department instead of an operating agency.
- The lead agency relies significantly on other State agencies and / or Local government, that is, programme management is dispersed, especially regarding regulatory powers, and there is no unified programme administration.

Examples of States that have adopted the networked approach include; Maine, Massachusetts, Oregon and Wisconsin. The institutional arrangements occurring within these States are briefly described over the page.

The Oregon programme differs from the other three in that the policy making body, the Land Conservation and Development Commission (LCDC) is an independent commission. Its members are appointed for staggered fixed terms, thereby providing it with some degree of autonomy from the State Governor. Also, the LCDC has very specific statutory authority for the development of State-wide land and water goals and for the approval of local comprehensive plans, a situation which is somewhat similar to the Californian programme mentioned previously. In common with the other three States programmes, the Oregon coastal programme is set within a larger land use planning scheme, and like all networked programmes, Oregon relies on other State authorities vested in 12 separate State agencies for implementation.

The Massachusetts programme, unlike the other three, has a management structure akin to an environmental super agency. The designated lead agency is the Office of Coastal Zone Management, which is a unit of the Office of the Secretary of Environmental Affairs. The Environmental Affairs secretariat, a cabinet office, provides for uniform administrative oversight and co-ordination of the States four primary operating environmental agencies, as well as the Department of Food and Agriculture. To gain a fully comprehensive coastal programme, memoranda of agreement (MOAs) with line agencies, both inside and outside the secretariat, were necessary.

Both the Wisconsin and Maine programmes represent the purest networked forms, relying on a State planning unit within the Governors executive management agency for programme management and implementation. In Maine, specifically, three State agencies are involved, these are; the Department of Environmental Protection, the Land Use Regulation Commission and the State Planning Office.[211]

All four of the above networked programmes work with local units of government by providing technical assistance, information and / or grants. Each utilises some form of regional (substate) administration / planning arrangement to bridge the gap between State and Local government. Maine, Oregon and Wisconsin additionally rely on local authorities to carry out their programmes, including mandatory shoreline zoning, subdivision review and enforcement of local plans.[210]

Within the USA there is a general political unwillingness to establish unified regional planning and management entities with strong implementation powers which usurp authority from existing institutional actors, that is, a legislative response. On top of this, great difficulty has been experienced in sustaining such arrangements in those comparatively few circumstances where they now exist. Therefore, networking existing units, laws and programmes to accomplish more comprehensive objectives such as changing the behaviour and activities of established agencies, that is, an organisational response, not only may be a more politically acceptable way, but often the only realistic opportunity for undertaking such management challenges through public institutions.[210]

7.5.1.2. *Institutional Arrangements in Australia.*

The Commonwealth of Australia has a Federal system of government, there are six State governments and two mainland Territories. Land management, including coastal zone management, is the responsibility of the individual States.[212]

Despite the small number of States and Territories present in Australia, variation has occurred in how they managing their coastal resources. However, the State of Western Australia stands out from the rest since it is the only one that does not have some form of coastal legislation. Instead in 1982 it was decided to plan and manage the Western Australian coastline by co-ordinating State development activities and by co-operative involvement with local authorities. At the same time, a Coastal Management Co-ordinating Committee was formed. It comprised senior officers of the following State departments; Conservation and Environmental, Public Works, Agriculture, Town Planning, Lands and Surveys and Marine and Harbours. The function of this Committee is to:

- Advise the Government through the State Planning Commission on coastal planning and management issues.
- Act as a steering committee for the preparation of coastal plans and studies carried out by Local governments.
- Act as a review board in the production of Local government coastal zone management plans. In this way, each of the member departments has an opportunity to ensure that its area of expertise has been adequately covered by the review process.

- Co-ordinate departmental activities relating to the coast through the exchange of information and views.

The present institutional arrangement for coastal planning and management in Western Australia is therefore one of co-ordinating a diverse range of specialist inputs across a large number of State departments, that is, an organisational response.

The major reason why it was resolved in 1982 not to introduce specific coastal legislation was because, unlike most of the other States and Territories, much of the coastal land in Western Australia is still vested in the Crown. Therefore, it was instead decided to use the existing property and conservation Acts to regulate coastal planning and management, and co-ordinate these by means of coastal policies or goals.

Owing to the fact that there is no specific coastal legislation to set up statutory working arrangements between Local and State government, a relationship based on co-operation emerged. Many Local governments have approached the Coastal Management Co-ordinating Committee for assistance in the preparation of coastal zone management plans, and by the late 1980s, 24 plans had been completed. These had been prepared on a co-operative basis between the State and Local government, with the Local government bodies benefiting from an input of special skills and a small financial grant programme to initiate the work.

This co-operative rather than legislative approach has been successful in that 22 out of the 24 plans were adopted, thus the benefits at the present time seem to be exceeding the disadvantages, making Western Australia's non-statutory approach a success.[197]

As for the remaining States and Territories of Australia, they have all followed a legislative response, producing statutory coastal legislation which enables the State departments given the responsibility for coastal management the power to come up with schemes concerning the coast, which local authorities are then responsible, legally, for implementing.[212]

7.5.1.3. *Institutional Arrangements in New Zealand.*

During a comprehensive review of the major laws that govern New Zealand's natural and physical resources, it was decided that considerable progress could be made through

institutional reform, and as a result, in October 1991 New Zealand's Resource Management Act came into force. This new Act effectively replaced more than 20 major statutes concerned with land, air and water resources, pollution and the coast.

The purpose of the Act is to promote the sustainable management of natural and physical resources by focusing decision making on results or 'intended outcomes' rather than on the regulation of resource uses. Two key changes are apparent, firstly, a very clear specification of the functional responsibilities between the planning and resource allocation agencies (Regional and District Councils) and the sectoral agencies (such as Transport and Agriculture and Fisheries) was established. Secondly, similar specifications were established between the national, regional and local levels of government. Transparency and separation of policy and operational functions, as well as horizontal and vertical co-ordination, were regarded as essential for consistent and integrated management.

Under the new Act, the central government was responsible for preparing, within one year of the Act's enactment, a draft national coastal policy statement. This involved extensive consultation among a broad range of stakeholders including; indigenous people, special interest groups and the general public, in order to develop a credible policy statement.
This statement would then provide the framework for more detailed coastal planning at the regional and local levels. Regional Council's were then to prepare regional coastal policy statements within 2 years of the Act's enactment. These statements are to be the primary working documents for coastal zone management, providing the basis for all planning, allocation and licensing decisions in coastal areas.
Under the Resource Management Act 1991, coastal zone management will apply to coastal land as well as coastal waters. Consistency will be achieved by making both coastal management and the management of inland waters the direct responsibility of Regional Council's, with the aim of reducing jurisdictional overlap through clarifying functional responsibilities. Though were applicable, it is recognised that appropriate coastal zone management areas may not coincide with long established administrative boundaries.
The opportunity or the willingness to undertake such a comprehensive review of existing legislative arrangements, that is, a legislative response to the development of institutional

arrangements, is probably not an easy task for most nations. Most will find it easier to adapt their existing separate structures to the task, that is, make an organisational response. Nevertheless, the New Zealand experience has identified areas for reform in existing coastal zone management arrangements. Even without broad legal changes, most nations can benefit by linking their existing structures into a more co-ordinated management approach, with higher order goals and objectives for the coastal zone and a rational working relationship involving all players.[208]

Regardless of the specific way institutional arrangements for coastal zone management have been developed within the above examples, the lessons that can be learned from such an examination of overseas practice must include the recognition that:

- Coasts are seen to be dynamic systems with a value to the nation as a whole because of their intrinsic ecological, aesthetic, cultural and other properties.
- Management through planning should include a consideration of the whole range of coastal assets and alternative uses.
- There is a general recognition that national government has to carry the responsibility for the creation of a national coastal zone management policy.
- Consultation is encouraged between policy makers and administrators at all levels from the national to the local, and public participation in discussion is also encouraged.
- The boundaries to the administrative units which happen to include a portion of the coast may not be coincident with the management unit required for effective coastal zone management.
- To many problems occur when local government takes unco-ordinated piecemeal action along separate administered sections of the coastline, and their actions need to be contained within an overall general coastal zone management strategy.
- National funds are used in support of the necessary and approved management strategies.
- Local flexibility and responsibility exists within national strategy.
- No country has found an 'easy' solution to the complexities of coastal zone management.[209]

7.5.2. Moves Towards Development of Institutional Arrangements in the UK.

Within the UK non-statutory management plans are becoming an important element in the co-ordination of decision making concerning coastal resource management issues. Three separate types of plan are emerging, these are; shoreline, estuary and coastal zone management plans.[213]

King and Bridge (1994) identified 90 non-statutory management plan initiatives in England alone in May 1994. Selected examples include; the Northumberland Coast Management Plan, the Wash Estuary Strategy for Sustainable Management, the West Sussex Coastal Strategy, the Arun District Local Coastal Management Plan, the Hampshire Coast Strategy, the South Wight Coastal Zone Management Plan, the New Forest Coastal Management Plan, the Coastal Strategy for Dorset, the Devon Coastal Statement, the Falmouth Bay and Estuaries Initiative, the Wirral Coastal Management Plan and the Sefton Coast Management Plan.[214]

Such widespread interest in management plans for coastal resource management is a clear indication that the framework for the management of the coast in the UK is changing in response to pressing issues on particular coasts. However, although such management plans can be completed by appropriate land use policies within development plans, their present 'ad hoc' nature and overlapping areas of interest may hinder their role in improving the effectiveness of coastal planning and management. Indeed, there is currently no mechanism for co-ordinating different plans covering the same stretch of coast, nor for linking with plans produced in neighbouring authorities.[213]

Such a situation gives cause for concern, since what is clear, as pointed out by the previous international examples, is that effective coastal zone management depends very much upon close co-ordination and co-operation between different interest groups to ensure that acceptable solutions are found to the conflicting resource demands made on the coast.

It is important that any future management framework for coastal zone management in the UK should therefore take into account the interests of all coastal zone users, and provide effective mechanisms for resolving conflicts. Effective coastal zone management must

therefore involve a broad strategic perspective at national, regional and local level and an appreciation of the nature of coastal change. Any decision making process will need to be based on adequate scientific understanding of coastal constraints and resources, and be able to take into account the potential effects of activities or uses on other equally important coastal zone interests. This will require an improved understanding of coastal systems and the interrelationship between coastal landforms and the habitats which they support.[213]

Concerned groups such as the Marine Conservation Society (MCS) have also proposed that any future framework for coastal zone management in the UK needs to operate at a national, regional and local level. The national level can set consistent objectives and policies for the management of the coastal zone throughout the country, the regional level allows plans to cover more realistically sized areas and management decisions to reflect regional differences and ensure that planning and management practices are not fragmented, whilst the local level is where problems, solutions and decisions discussed at the regional level can be implemented for specific sites, such as estuaries, which have particular problems that need concerted action.

Past recommendations, present policies and possible future initiatives concerning the development of institutional arrangements for coastal zone management in the UK, and Moray Firth particularly, are discussed along national, regional and local lines below.

7.5.2.1. *National Level.*

As outlined in the lessons to be learned from the selected international examples in Section 10.2, there is a general recognition that national government has to carry the responsibility for the creation of a national coastal zone management policy.[209] Put simply, the requirements at the national level are essentially to actively encourage the development of the necessary management structures, that is, institutional arrangements, at regional and local levels and to provide some strategic control over coastal resource use as a whole.[8]

In the early 1990s, UK researchers in the field of coastal zone management offered a number of recommendations concerning coastal zone management at the national level.

The prime mover was the Marine Conservation Society (MCS) in reports prepared with the support of the World Wide Fund for Nature (WWF).

In 1990, recommendations were made for new coastal zone management legislation. It was argued that new primary legislation was central to the successful introduction of coastal zone management in the UK, since legislation would set out consistent objectives for the management of the coastal zone throughout the country and would ensure that attention was focused on the coast. This would ensure that the coast was seen as a unit for planning purposes and would recognise that it is an area under particular pressure.[215]

In addition, it was stated that a UK Coastal Zone Management Act would provide a framework, support and incentive to implement the idea, and would be a reference point against which to measure progress and provide guidance in dealing with new initiatives and uses of the coastal zone.[215]

Following the recommendation for new legislation, calls were then made for institutional change, that is, the establishment of a coastal zone management unit. In a 1991 Discussion Paper prepared by the Marine Conservation Society (MCS) entitled "A Coastal Zone Management 'Unit' for the UK", three options in order of preference were outlined concerning the issue of where a coastal zone management unit for the UK should be based and how it should operate.

- Option 1: A new agency to act as the coastal zone management unit. This would allow all coastal zone management related work to be concentrated in one body, which would be independent of sectorial interests, and be most effective in developing integrated coastal zone management policies.
- Option 2: A coastal zone management unit operating under the auspices of the Department of the Environment (DoE), but as a separate agency. The DoE umbrella could provide an underlying environmental basis for coastal zone management and representations at Cabinet level, whilst the unit could concentrate on the technical management work. However, in this, and the scenario below, the issue of UK wide responsibilities would need to be resolved.

- Option 3: A coastal zone management unit within the Department of the Environment (DoE). Apart from providing the environmental base, the DoE already has a broad range of the expertise and responsibilities needed to take on this role. The mandate for dealing with a range of sea use management issues as part of the North Sea Ministerial conferences, and the planning remit and co-ordinating role it played in the preparation of the government White Paper 'Our Common Inheritance' are examples of this.[216]

With regard to the issue of UK wide responsibilities mentioned in Option 2, the Scottish Wildlife & Countryside Link published a report in 1993 entitled "All at Sea ? Coastal Zone Management - The Case for Scotland." One of the main recommendations was the identification of a lead agency to act as a focus for Scottish coastal issues, and to play a lead role in providing a UK perspective to the management of coastal matters.

It was recommended that the Scottish Office should establish a unit or agency to co-ordinate the government departments responsible for different aspects of the Scottish coast, and the policies which they produce. One option put forward was the formation or identification of a Coastal Division which could act as a focus for coastal matters. This division would liaise and co-ordinate the Scottish response to coastal matters, and set out a broad policy for the Scottish coast. It was also suggested that such a Coastal Division should be part of the main Scottish Office, for example, within the Scottish Office Agriculture and Fisheries Department (SOAFD) or Environment Department (SOEnD).

Although any Coastal Division should take a strategic overview of the management of the Scottish coast, it is important that there is a consistent approach to the management of the coastal resource south of the border. The Coastal Division could therefore act as a focus for feeding into the UK process by interacting with the Inter-Department Group (IDG) set up by the UK government after the House of Commons Environment Select Committee Report into Coastal Protection and Planning in 1992. It was recommended that the Coastal Division should take an active part in the IDG and help develop a UK wide perspective.[217]

Whilst the above suggestions involve major institutional or legislative change they should not be viewed automatically as a panacea for coastal zone management.[213] For example,

as outlined by the Western Australian example, there is not an automatic need for any statutory coastal zone management legislation, and as the networking examples form the USA show, there is no automatic need for the creation of a new coastal zone management unit in order to progress the idea of coastal zone management.

Most recent government policy is set out in two papers published in 1993 relating to coastal policy in England and Wales. These documents restate government policy that coastal zone management in general is supported in principle through a mechanism of voluntary partnership agreements without overreaching new institutions or legislation.[218] This policy has resulted in the establishment of a National Coastal Forum for England which was launched in December 1994, with the principal objective of long-term development of coastal zone management in England by promoting co-operation between different agencies and between national, regional and local bodies.[219] Coastal policy in Scotland is due to be set out in detail with the publication of a Scottish Office paper in the near future.[130]

7.5.2.2. *Regional Level.*

The main issues and priorities identified at national level which need to be addressed by coastal zone management are bound to vary from one part of the country to another. Therefore, the two main aims of coastal zone management at a regional level are to identify regional variations along the coast, and to ensure that management practices at a local level are not so fragmented that one programme undermines another.

At present there are no formally recognised regions for coastal zone management in the UK. However, a Discussion Paper issued by the Marine Conservation Society (MCS) in 1992 entitled "Regions for Coastal Zone Management" recommended a division of the UK coast into 21 regions defined on the basis of coastal cell structure and then modified in the light of other factors such as environmental, economic and administrative influences.[220] Figure 19 over the page illustrates those regions proposed for coastal zone management in the UK, while Table 44 over the next page outlines them geographically.

Figure 19: Proposed Regions for Coastal Zone Management in the UK.[220]

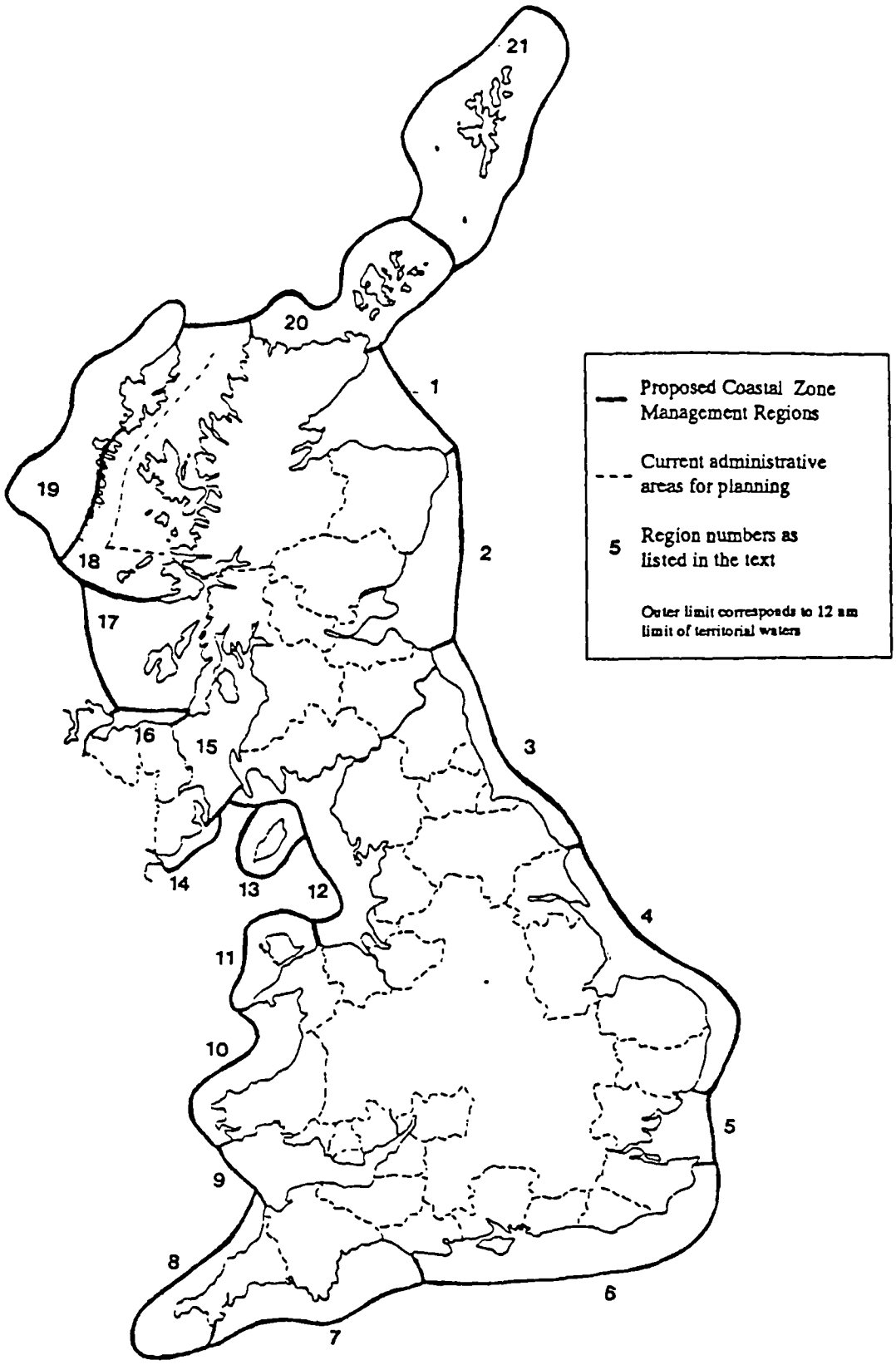


Table 44: Geographical Area Cover by the Proposed Regions for CZM.[220]

Region	Geographical Area Covered
Region 1	Wick to Rattray Head
Region 2	Rattray Head to St. Abbs Head
Region 3	St. Abbs Head to Flamborough Head
Region 4	Flamborough Head to Felixstowe
Region 5	Felixstowe to Ramsgate
Region 6	Ramesgate to Portland Bill
Region 7	Portland Bill to Lizard Point
Region 8	Lizard Point to Hartland Point (including Isles of Scilly)
Region 9	Hartland Point to St. Govans Head
Region 10	St. Govans Head to Braich y Pwll
Region 11	Braich y Pwll to Great Ormes Head
Region 12	Great Ormes Head to Ardwell Point
Region 13	Isle of Man
Region 14	Carlingford Lough to Ballyquintin Point
Region 15	Ballyquintin Point to Ardwell Point to Mull of Kintyre / Torr Head
Region 16	Torr Head to Lough Foyle (including Rathlin)
Region 17	Mull of Kintyre to Iona (including Jura and Islay)
Region 18	Iona / Barra Head to Butt of Lewis / Cape Wrath
Region 19	Barra Head to Butt of Lewis (western coasts)
Region 20	Cape Wrath to Seal Skerry (Orkney) to Wick
Region 21	Seal Skerry (Orkney) to Unst (Shetland)

Support for the concept of coastal regions for coastal zone management was also expressed by the House of Commons Environment Committee in 1992, when they described coastal zone management as –"balancing demands for coastal zone resources, to promote their sustainable use and, as far as possible, to resolve conflicts of use by integrating planning and management within coastal 'cells' that are defined by natural coastal processes rather that by administrative boundaries."[132]

Within Figure 19, coastal region one roughly equates to the case study area of this thesis, that is, the Moray Firth. Therefore, this region is a convenient example to use in considering the institutional arrangements for coastal zone management at a regional level.

As stated previously, the main aims of coastal zone management at the regional level are to allow for regional variations along the coast, that is, provide flexibility from the national level, and to avoid the fragmentation that has already occurred within the UK when individual administrative areas produce management plans in isolation.

The three main keys to achieving these aims are information, co-operation and negotiation. Information is important because it is only by having a proper understanding of the coastal zone, its processes and characteristics, that issues and priorities relevant to the coastal zone concerned can be identified. Once identified it is as a result, ideally, though other methods are available (see Section 8.2), of co-operation and negotiation by those concerned with making management decisions that such issues and priorities can be addressed at a regional level in an integrated non-piecemeal fashion, avoiding fragmentation, isolation and possible conflicts.[221]

One possible way of obtaining the required information, co-operation and negotiation is via the establishment of a voluntary coastal group for the region concerned, that would act as an 'umbrella' mechanism to deal with issues effecting the coastal zone within the region. Such a group should be multi-disciplinary based, with members from the public, private and voluntary sectors, brought together to identify issues and priorities that need to be addressed in any subsequent management plans.

A successful format that could feasibly be copied within the Moray Firth, is the establishment of the Forth Estuary Forum for the Firth of Forth as part of Scottish Natural Heritage's Focus on Firths Initiative, of which the Moray Firth is a part. This Forum is a voluntary partnership of organisations who wish to have a say in the future of the estuary, which is defined as stretching from the Isle of May at its North Sea entrance to its tidal limit at Stirling Brig. Among the Forums participants are representatives from industry, commerce, local authorities, conservation groups and recreational interests. There are over 175 participants at present.[222]

The structure of the Forum consists of a Core Management Group, Secretariat and a series of Topic Groups, formed as and when required, to undertake the bulk of the work.

The Core Management Group consists of the principal representatives of the various interests around the Forth who are participating in the Forum. Sixteen organisations are represented in the Core Management Group, who together represent a balanced range of

interests and user groups from around the Forth, including local communities. The Group meets every two or three months to co-ordinate and manage the ongoing work programme.

The Secretariat is provided by a project officer funded under the SNH Focus on Firths Initiative, who acts as secretary and co-ordinator for the Form. Presently, this is Mr Mark Jennison, a former MSc student and employee of the Institute of Offshore Engineering (IOE), Heriot-Watt University.

Topic Groups have been set up to tackle specific issues or progress various initiatives, as and when required by the Forum. These groups are concerned with; uses of the Forth and how they interact with other uses or with the Forth's environment, projects that would benefit all users of the Forth or with ways to improve the effectiveness of the Forum. To date Topic Groups formed are concerned with:

- Marine and Coastal Pollution.
- Tourism and Recreation.
- Coastal Defence.
- Nature Conservation.
- Landscape and Amenity.
- Built and Archaeological Heritage.
- Information and Research (GIS).
- Awareness and Education.
- Economic Development.

These nine Topic Groups comprise representatives of different organisations, specific interest groups, and / or individuals with specialist expertise and knowledge of the topic in question. The groups will identify, and then formulate, management recommendations to address and resolve issues, for example conflicts of interest, or develop certain opportunities, for example environmental improvements. The representatives, under the auspices of the Topic Group, can best address specific issues which otherwise would not be addressed by the Core Management Group. The support they provide for the Core Management Group helps to set targets and priorities, aid future management decisions, and enlighten members to a variety of viewpoints.

The Topic Groups publish their deliberations in the form of a series of Topic Papers. These provide the Core Management Group, in a concise and readily usable form, with information about specific uses, issues and opportunities, and highlight potential or actual conflicts of interest and the implications of these for future management options. In short, they fill current gaps in information and ensure that management decision making is informed. Consultation with the entire Forum membership occurs during the production of the papers and at the end of its work schedule the Topic Group is then be dissolved. The first Topic Papers are expected to be ready for consultation this summer (1995), with the other papers following at regular intervals over the following year and a half.[218,204] The advantages of such a structure include:

- The participation of all those involved in the coastal zone, resulting in wide acceptance and successful implementation of management plans.
- The easier exchange of knowledge and expertise, and greater consensus building between groups of people who may more normally work in opposition to each other.
- A greater ability to influence attitudes and behaviour.
- Using the combined body of local knowledge and expertise of the coastal management group or forum to widen support for sustainable economic use and coastal zone management.[221]

Within the Moray Firth, the development of an equivalent regional institutional structure would go a long way to achieving the aims and objectives of the management framework for coastal zone management, as identified in Section 7.2.

Initially what would be required to achieve this are direct consultations in order to identify those users of the Moray Firth that would be willing to actively participate in a region wide 'Moray Firth Coastal Forum', that would treat the entire Firth as a single ecosystem. To this end, some preliminary consultations have already been carried out by Scottish Natural Heritage (SNH) though these are at a very early stage.[222]

Once identified, principal representatives of the various uses of the Moray Firth willing to participate in a regional Forum could then be selected to form a Core Management Group. As stated previously, to be effective such a Group would have to represent a balanced

range of interests and user groups from around the Firth. With this in mind, the composition of a Core Management Group could feasibly be as follows:

- One representative each, as of April 1996, from Highland, Moray and Aberdeenshire Council's. Each would represent the views of their Planning and Development Departments, Tourist Boards and Coastal Protection Departments.
- One representative from the Scottish Office, to represent the views of the various departments, particularly the Agriculture and Fisheries Department (SOAFD) and Environment Department (SOEnD).
- One representative from the Crown Estate or their agents Messers Montague Evans.
- One voted or agreed representative of Fisheries interests, for example, from one of the local Fishermen's Associations such as the Fraserburgh Inshore Fisherman Ltd, or the North East of Scotland Fishermen's Organisation.
- One voted or agreed representative of Aquaculture interests, for example, one of the local fish farmers or an Association of Scottish Shellfish Growers representative.
- One voted or agreed representative of Industrial interests, including the aggregate and hydrocarbon industries, for example, a Cromarty Firth Industries Group representative.
- One representative from both Highland River Purification Board and North East River Purification Board. (Scottish Environmental Protection Agency (SEPA) as of 1996)
- One voted or agreed representative of Port and Harbour interests, for example, a Cromarty Firth Port Authority representative.
- One voted or agreed representative of Nature Conservation interests, for example, a RSPB, Scottish Wildlife Trust or SNH representative.
- One voted or agreed representative of Recreational interests, for example, from the North of Scotland Yachting Association, British Association of Shooting & Conservation (BASC) or the Sports Council.
- One voted or agreed representative of Coastal Community interests, for example, a Local Residents Association representative.
- One representative from the Ministry of Defence (MoD).

Such a 15 member Core Management Group structure would indeed represent a balanced range of interests and user groups from around the Moray Firth. This number has also been suggested as the maximum recommended membership size by those already involved in such groups.[221]

As with the Forth Estuary Forum, the Secretariat for the Moray Firth Coastal Forum could be provided by the SNH Project Officer for the Moray Firth. However, it should be stressed that this is not a 'given' role under SNH's mandate, and that the only major requirements needed to act as secretary and co-ordinator for such a Forum would be patience, determination and a commitment to both the sustainable ecological development, and rationalisation of administraton and utilisation of the Moray Firth coastal zone.

As stated previously, Topic Groups would be set up to tackle specific coastal zone issues of concern, or progress various initiatives as and when required by the Forum. Research already carried out during the course of this thesis (see Chapter 6) suggests that within the Moray Firth, initial Topic Groups would be required that were concerned with:

- Marine and Coastal Pollution.
- Recreation and Tourism.
- Nature Conservation.
- Sustainable Economic Development.
- Information Systems (GIS).
- Public Participation, Awareness and Education.
- Conflict Management and Resolution.

As with the Forth Estuary Forum, each of the above Topic Groups would ideally comprise representatives of different organisations, specific interest groups, and / or individuals with specific expertise and knowledge of the topic in question. Their findings would be published in Topic Papers which would provide information for the Core Management Group to help shape future management and planning decision making, and enlighten members to a variety of viewpoints.

Consultation with the entire Forum membership would occur during the production of these papers, in addition to being kept up to date concerning management and planning

decisions through the publication of a Forum newsletter. General discussion should also take place between the entire Forum membership at an annual or biannual general meeting, along the lines of the present Scottish Wildlife Trusts annual series of open meeting entitled 'Future Firths' (see Section 7.4.3.1).

Within the Moray Firth, the precedent has been set for the establishment of voluntary coastal groups, however, so far they are of a varying local nature. These groups include; the Cromarty Firth Liaison Group, Findhorn Bay Proposed Local Nature Reserve Steering Committee, Scottish Wildlife Trust Inner Firth Environmental Forum and Grampian Coastal Forum.

Any regional Forum established should not undermine the actions of such local groups. Instead the regional Forum should act very much as an unifying force, identifying issues and priorities of a regional nature and pooling information from local groups, while still allowing them to focus on specific sites, such as estuaries and bays which have particular problems that need concerted action.

A more unorthodox role for such a regional Forum would be, to some degree, to protect the integrity of management decisions made concerning the coastal zone from activities considered to be of a strategic value, and so sponsored or approved by central government. Under such conditions the Forum, if in agreement, could act as a campaign group opposed to the strategic override of management decisions, along similar lines to the 'consistency review' under Section 307 of the American Coastal Zone Management Act of 1972.[223]

7.5.2.3. *Local Level.*

The main instrument of coastal zone management will be the implementation of management decisions at the local level which take regional policies into account, as well as the national perspective.

As previously stated, coastal management groups as proposed above have no specific statutory authority. Rather they rely on consensus and agreement for voluntary actions and the powers of the participating authorities. In many instances however, voluntary measures are preferable, even where statutory measures are available, because they are

more flexible, promote an air of good will, are supported by those whom they effect, do not require strict enforcement and are very often cheaper to implement.[221]

Therefore, implementation of management decisions will principally depend on the commitment of all those associated with a regional Forum, that is; landowners, local communities, existing organisations and other agencies.[224]

7.5.2.3.1. Landowners.

The co-operation of landowners, for example; farmers, businesses, port authorities and private individuals, is essential to achieving the management decisions identified by a regional Forum.[225] It is landowners that have the greatest influence in determining such things as the future of the coastal landscape, both in its richness of features and wealth of its wildlife, as well as rights of way and amenity value for recreation.[226]

7.5.2.3.2. Local Communities and Voluntary Organisations.

Individuals, schools, societies and voluntary groups take an active role in improving their local environment, whether by helping to remove litter, suggesting local improvements or by disseminating information concerning the coastal zone to visitors and other locals alike. It is vital that community initiatives are supported, as such local voluntary effort and specialist knowledge will have a vital role to play in the implementation of coastal zone management decisions.[226]

7.5.2.3.3. Conservation Organisations.

Conservation organisations such as Scottish Natural Heritage (SNH), the Royal Society for the Protection of Birds (RSPB) and the Scottish Wildlife Trust, all own or manage areas of the Moray Firth coastal zone. Management and conservation practices within the coastal zone have been pioneered by these organisations, and this expert advice is available on the implications of particular management decisions.[225]

7.5.2.3.4. Planning Authorities, Government Departments and Statutory Bodies.

Planning authorities, government departments and statutory bodies between them have control over, or own a significant portion of the Moray Firth coastal fringe. As a result

they can help to implement management decisions when carrying out their various functions. It is particularly desirable that these public bodies show the way forward by adopting coastal zone management aims and objectives in the everyday management of their land and in the wider implementation of policies. An important way of doing this would be by modifying standard procedures and designs in ways sensitive to the needs of the coastal zone.[226]

The most important of these bodies are the; Scottish Office Agriculture and Fisheries Department (SOAFD), Scottish Office Environment Department (SOEnD), Department of Transport (DoT), Department of Trade and Industry (DTI), Ministry of Defence (MoD), Highland River Purification Board (HRPB), North East River Purification Board (NERPB), Scottish Natural Heritage (SNH), Crown Estates and the planning authorities (Highland, Moray and Aberdeenshire Unitary Authorities, April 1996). All these bodies carryout various activities within the Moray Firth coastal zone, and it is vital that when they do so, they operate in the full knowledge of coastal zone management aims and objectives, and match their work to these.

Chapter 8: Conflict Management & Resolution in the Coastal Zone.

8.1. *Introduction.*

It has been hypothesised that the interface between land and sea, the coastal zone, was the cradle of civilisation. Rich in both marine and terrestrial resources, the coastal zone allowed once nomadic hunter gathers to establish permanent settlements and provide support for expanding populations. Such growth led to increased social complexity involving, for example, higher degrees of social stratification, more complex political and legal systems, and often, warfare with neighbouring groups. Conflicts may also have arisen due to disputes over coastal territory, and the resources within them. Thus, the management of coastal zone conflicts of use had to have been an early concern of humans.[227]

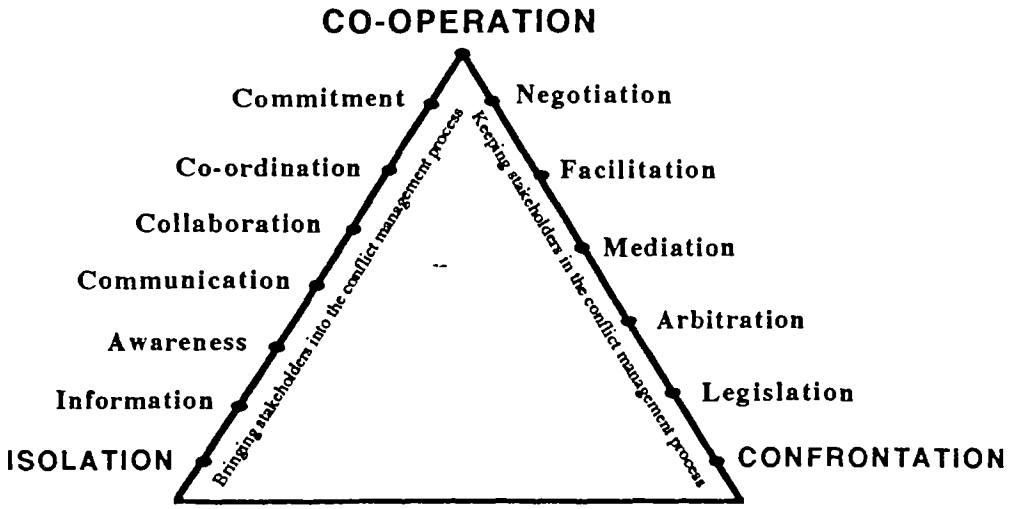
The passage of time has not diminished the requirement to understand and manage these conflicts. On the contrary, the incidence of such conflicts has only increased and their management has become ever more complex. Concern for the environment, increasing demand for coastal leisure and recreation, increasing demand for coastal property, the traditional and future needs of commerce and increasing demand for inshore oil, gas and mineral resources have led to an array of competing users, often with equally competing philosophies on the proper place of coastal resources in the cultural milieu. Such competition has often led to conflicts of use within the coastal zone (see Chapter 6).[227] The strategies and techniques concerned with the management and acceptable resolution of such coastal zone conflicts are the focus of this chapter.

8.2. *Conflict Management Strategies.*

Strategies for conflict management range from war at one extreme to complete isolation and non-involvement at the other. The possible range of suitable strategies is indicated in Figure 20 over the page. At the extreme ends of the management range are those approaches best described as a failure of the system. Apathy on the one hand, and war on the other are the opposite poles to co-operative management. Isolation and confrontation

are the strategies for conflict management applied at these extremes. The use of either by any party, that is, coastal zone stakeholder (see Section 7.4.1), involved in a conflict makes constructive management difficult. Therefore, any strategies falling short of these two extremes represent a step in the right direction.[228]

Figure 20: Conflict Management - Scaling the Mountain.[228]



In Figure 20 conflict management is represented as a mountain to be climbed. The first step along the path to reaching the summit, and achieving co-operative management, is to bring all the stakeholders within the coastal zone into the conflict management process. This is particularly important because we live in a specialised, competitive society, and therefore the different stakeholders are almost certain to start from a professionally isolated position.[228]

Reducing the individual isolation of the many stakeholders of the coastal zone is one of the main aims of coastal zone management. The management response option outlined within this thesis to achieve this aim is the development of options for institutional arrangements (see Chapter 7, Section 7.5). Within Chapter 7, the principal option put forward is the development of multi-disciplinary based voluntary coastal groups or forums. Such coastal groups or forums would be invaluable to the process of conflict management as they would provide a unique setting within which people representing many different coastal zone interests could meet and explain their perspectives, raise issues and seek to resolve

conflicts before they become major problems with interested parties developing entrenched views.[229]

That is to say, the sharing of information between different stakeholders that would occur within such coastal groups or forums would be the equivalent of a formal identification of actual or potential conflicts of interest within the coastal zone (see Chapter 6). Such a process of identification would result in a heightened sense of awareness concerning the direct and indirect consequences of the actions of one set of stakeholders upon others within the coastal zone.

Once specific conflicts have been identified, informal communication between the parties involved would result in both parties learning more of each other's positions and interests.[228] From such a dialogue it may be possible for the parties involved to act together on specific issues of concern identified, that is, collaborate in a co-ordinated manner in an attempt to achieve a satisfactory resolution to the conflict between them. However, the possibility of attaining any kind of resolution can only be achieved with the full commitment of the parties involved.

In this way, it is possible to resolve many of the conflicts of use which can occur within the coastal zone through the collaboration which arises from informal communication.[229] For example, within the Moray Firth coastal zone, it may be possible to satisfactorily resolve some of the conflicts of use identified between stakeholders in Chapter 6 if the parties involved were simply made aware of the issues involved and the problems that result from a particular conflict, although it must be stressed that each conflict would have to be assessed on an individual basis.

Specific examples where this may be applicable include; the damaging effect bait digging has on fish stocks when it is carried out in fish nursery areas, as well as the threat to public safety that occurs when holes are not backfilled,[126] the hazard to navigation that lobster creel buoys pose to yachtsmen,[94, 95, 96] the potential hazard that inshore aquaculture developments pose to navigation,[164] as well as the conflicts that arise from the effects that noise pollution can have on wildlife, for example the effect that generator drone from rigs

berthed in the Cromarty Firth has on the flightlines and distribution of wildfowl in the Firth.[88]

However, it is not always possible to resolve such conflicts simply by bringing all the stakeholders into the conflict management process, and therefore, alternative arrangements are necessary for this eventuality.[229] That is to say, when co-operation is threatened with collapse, or more likely, if it has yet to be achieved, remedial measures will be needed to keep the stakeholders of the coastal zone within the conflict management process. On the confrontation slope of the conflict management mountain (see Figure 20), the task is either to reduce existing conflicts (starting at the bottom) or to maintain the hard-won co-operation (stopping a slide from the top).[228] Strategies available for the management of conflicts to achieve this include; confrontation, legislation, arbitration, mediation, facilitation and negotiation. Each of these strategies are briefly discussed below.

8.2.1. Confrontation and Legislation.

Short of outright war, confrontation is the next most destructive way of approaching conflict. Such conflicts are often only solved by the use of legislation, involving sanctions for disobedience. However, this solution applies only after those wielding power, or where the bulk of the population, have become sufficiently concerned regarding the nature of the conflict.[228]

8.2.2. Arbitration.

Above both confrontation and legislation comes arbitration. This is a means of settling disputes where a decision is made on the conflicting claims of the parties in the dispute through appealing to a specialised tribunal.[230]

8.2.3. Mediation.

Mediation is a broad concept which includes all forms of third party intervention in a conflict, except those where the third party is an adjudicator of the rival claims (arbitration) or where the third party actively supports one party (advocacy).[230] Mediation is a useful tool for solving entrenched problems.[228] It is a process whereby a third party attempts to secure settlement of a dispute by persuading the parties either to continue their negotiations

or to consider procedural or substantive recommendations that the mediator may make. In the final analysis however, the decision on acceptance or rejection of recommendations made by the mediator is left to the parties in conflict.[230]

8.2.4. Facilitation.

A stage further up from mediation comes facilitation. The use of a facilitator is a less formal process than employing a trained mediator. Facilitation involves setting up and enabling a constructive, problem solving environment for the stakeholders in an issue. The facilitator, who is usually someone perceived as neutral by all the participants, sets and keeps the ground rules until resolution is achieved.[228]

8.2.5. Negotiation.

Conflict management strategies become increasingly less intrusive within the management process as one proceeds up the incline from confrontation to facilitation in Figure 20. The final strategy, negotiation, whether applied within the everyday processes of management, or specifically convened to resolve a major issue, is the crucial strategy. It is a process through which the stakeholders interact in developing potential agreements to provide guidance and regulation of their future behaviour. Negotiation is applied to interactions where both parties retain their original objectives as desirable value positions, but recognise that there are constraints which prevent these being reached and so accept that a value position must be sought which although sub-optimal is still satisfactory.[230]

Where a coastal zone conflict of use can not be solved by a stakeholder becoming aware of the consequences of its actions upon other coastal zone stakeholders, and therefore taking suitable action to ameliorate those consequences, participation in negotiation is considered the crucial strategy because it is the next best strategy to achieve co-operative coastal zone management. This is because the conflict resolution decisions that evolve out of negotiation prove far more binding to all concerned than those that arise from the other strategies mentioned above, and are therefore easier to implement and enforce. The main reason for this is the fact that the decisions reached are in no way imposed upon the conflicting stakeholders by outside third parties.

8.3. *Conflict Resolution Techniques.*

Once decisions concerning coastal zone conflicts of use have been reached by the parties involved, via the use of the conflict management strategies described above, the next task is to translate those decisions into technical resolution measures 'on the ground'.[231]

Categories of technical measures associated with coastal zone conflict resolution include; codes of practice, development controls, bye-laws, information and education, pricing mechanisms, facility provision, equipment and quota controls, access allocation and zoning. These measures are discussed in more detail below.

8.3.1. Codes of Practice.

Codes of practice are increasingly being utilised within the coastal zone to resolve conflicts of use between stakeholders. They can arise as a result of negotiations between two conflicting parties, or be developed unilaterally by one set of users in an attempt to ensure that their actions impact as little as possible upon the interests of other users as well as the natural environment.

An example of a code of practice that was developed as a result of negotiations between the parties involved in a conflict of use is the code of practice that exists between fishing organisations and the oil industry within the Moray Firth. Its contents were negotiated by representatives of the fishing and oil industries during sessions of the Fisheries and Offshore Oil Consultation Group (see Section 5.9). The purpose of the code is to provide ground rules for the conduct of exploitation development and production activities with special regard to the interests of fishing activity within the Moray Firth west of a straight line drawn between Duncansby Head and Rattray Point.[232] The code is comprised of the following parts:

- Appointment of a co-ordinating officer
- Notification of seismic surveys
- Drilling proposals
- Consideration of claims
- Post drilling requirements
- Suspended wells

- Buoys
- Supply vessels
- Cleaning up of supply routes
- Safety zones
- Good housekeeping practice

Outlined below in more detail are those parts of the code that are specifically aimed at resolving actual or potential areas of conflict that could arise between the fishing and oil industries within the Moray Firth (see Section 6.2.2.4).

- Notification of seismic surveys: The code highlights the need to give interested parties notice of intended seismic surveys. Specifically, operators are to give at least 40 days notice, so that the Scottish Office Agriculture and Fisheries Department (SOAFD) are able to inform the Moray Firth fishing organisations in good time.
- Consideration of claims: Fishermen are able to claim for loss of, or damage to fishing gear and resultant hardship caused by oil related debris. The operator undertakes to consider and determine such claims within three months following receipt of full documentation concerning the incident.
- Clean-up of supply vessel routes: The operators in the inner Moray Firth will arrange for trawls and / or side scan surveys to be carried out and any necessary cleaning-up operations to be undertaken along routes used by supply vessels.
- Good housekeeping practices: Operators are to ensure by education and other means that their offshore personnel and those of their contractors exercise great care regarding the storage and disposal of all items of equipment which are used or transported offshore.[232]

Consultations with fishermen have confirmed that, in their opinion, conflicts between the fishing and oil industries within the Moray Firth would be very much worse than at present if it were not for the code of practice outlined above.[159]

Many of the sporting activities that take place within the Moray Firth coastal zone are governed by codes of practice and behaviour which, in contrast to the one outlined above, have been developed unilaterally by the sports governing bodies. At present codes have

been developed that cover jet skiing, canoeing, wildfowling and yachting.[233] However, the impetus for developing these codes has as much, if not more, to do with encouraging safe participation as it does with regulating behaviour and developing or maintaining good relations with other users of the coastal zone.

8.3.2. Development Controls.

The use of development controls is closely related to the principle of zoning (see Section 8.3.8 and Chapter 9), in that they both result in the physical separation of potentially conflicting interests and uses within the coastal zone.

Within the Moray Firth coastal zone, the most well known and extensive attempt to use development controls to resolve a conflict of use was the development of guidelines relating to shore based North Sea oil and gas developments in Scotland. Here, Preferred Development Zones and Preferred Conservation Zones were established in order to resolve the conflict between the need for conservation within the Moray Firth coastal zone, and the need for industrial development related to the discovery of offshore hydrocarbon deposits in the Moray Firth itself and wider North Sea (see Section 5.3.1).[129]

Other types of development controls include those associated with the town and country planning system (see Section 5.2), as well as setback lines and buffer zones which have been widely utilised within the USA to control development within the coastal zone.[234]

8.3.3. Bye-laws.

Local government bye-laws issued under the Civic Government (Scotland) Act 1982 can be used to resolve conflicts of use in the coastal zone. However, as indicated in Section 8.2.1, the use of legislation to resolve conflicts within the coastal zone is not the most desirable of the strategies available. The use of bye-laws imposes restrictions on the activities of those users involved, as opposed to the securing of voluntary regulation on behaviour that can be achieved by other means such as negotiation. As a result, bye-laws may often be resented and / or ignored by the users they are aimed at, and are certainly harder and more expensive to implement and enforce than restrictions reached via negotiations that maintain the good will and co-operation of all those concerned.

8.3.4. Information and Education.

This technique is an extension of the concept mentioned in Section 8.2. That is, if users of the coastal zone can be made aware of the derogatory consequences of their actions, they may voluntarily decide to alter their behaviour in order to avoid potential, or resolve actual conflicts within the coastal zone.

An example of how education is being used to this affect within the Moray Firth is the production of an educational pamphlet by SNH entitled "Dolphin Awareness: Dolphins, Porpoises and Whales of the Moray Firth." This pamphlet is specifically targeted at the owners of speedboats and jet skis and outlines the effects these craft can have on dolphins and porpoises when used inconsiderately. For example, it states that dolphins and porpoises can be affected either directly from injuries received in collisions, or indirectly through noise generated underwater by the craft's propulsion systems interfering with their echo-location systems. The pamphlet then goes on to suggest guidelines that should be followed by speed boat and jet ski users when dolphins and porpoises are sighted within the Moray Firth. These guideline are as follows:

- Avoid sudden changes in speed or direction. Slowing down suddenly will confuse and scare dolphins or porpoises as much as speeding up.
- Avoid travelling at high speed.
- Look out for groups of dolphins or porpoises and avoid heading straight for them as they may not be aware you are there.
- Avoid swimming with, touching or feeding dolphins, for your safety and theirs. Remember, they are wild animals.[235]

It is hoped that by raising the awareness of speed boat and jet ski users, incidents between them and cetaceans in general within the Moray Firth can be kept to an absolute minimum.

8.3.5. Facility Provision.

Where the root cause of a conflict of use is a lack of suitable facilities, for example, car parks, slipways or moorings etc, the conflict resolution technique most suitable for the satisfactory resolution of the conflict for all parties concerned is the provision of the

required facilities or the improvement of existing ones. There are two main ways that user groups involved in such conflicts can obtain facility provision, however, both require co-operation and commitment on the part of the user groups concerned.

Firstly, the user groups can co-operate to make joint representations where the provision of the required facilities is the responsibility of other bodies. For example, along much of the southern coast of the Moray Firth, the provision and maintenance of slipways and harbours is the responsibility of Grampian Regional Council in its capacity as harbour authority within the region. Secondly, the user groups can co-operate together to provide the facilities they require themselves. This would involve the obtaining of planning permission and raising of finance, however, once complete income could then be raised by charging for the use of the facilities.

8.3.6. Equipment and Quota Controls.

The main example of the use of equipment and quota controls within the coastal zone are those applied to the fishing industry in an attempt to conserve fish stocks. These controls, and the regulations enforcing them are described in Section 5.6.

8.3.7. Access Allocation.

Systems of access allocation have the effect of limiting the numbers of the public in general entering a particular area, or can be used to exert control over levels of individuals involved in a particular use within an area.

An example of the former is the way general access to designated conservation areas such as National Parks and National Nature Reserves (NNRs) can be controlled. A specific example of this is where there is an extreme risk of fire during a prolonged period of dry weather. In such cases, access to the general public can be restricted or stopped all together to protect the environment from the damage caused by fire.

An example of the latter use of access allocation is the use of permit systems to control specific activities within an area. For example, permit systems have been in operation within some National Nature Reserves (NNRs) since 1954 to control the level of access and activities of individuals involved in wildfowling. Two main types of access allocation

systems utilising permits have evolved to control wildfowling, one where spatial consideration are paramount, and another where temporal considerations dominate. Specific examples of both types of systems are described below.

Within the Bridgewater Bay National Nature Reserve (NNR) in Somerset a spatial system of access allocation is in operation, involving three types of areas associated with wildfowling activity. There is an excepted area where no permit is required, a permit area and a sanctuary area where no shooting is allowed at all to avoid disturbance within roosting areas. Within the permit area, the Bridgewater Bay Wildfowling Association operates a permit system, issuing 40 permits a year. Each permit allows one club member to shoot over the specified area. An additional permit return system then requires the permit holders to register the number of birds shot, species, sex and weight of birds shot and the exact time when and location were each bird was shot. Failure to return permits results in a ban from shooting on the reserve for three years.

In contrast, Loch Leven National Nature Reserve (NNR) near Kinloss operates a permit system that relies on temporal as opposed to the spatial considerations. Within the reserve shooting is allowed over the whole loch for six weeks (Monday to Saturday) each winter. Specifically, this breaks down into one week in October, two in November, one in December and two in January. Four shooters are allowed each day. The maximum, and usual, seasonal total of wildfowler days is 144, and the number of individuals shooting is 30 to 35.[236]

Regardless of being either spatially or temporally oriented, such permit systems also allow for the control of visiting and non-club affiliated shooters. Where permit systems are not in operation, local wildfowling clubs have no other way of controlling the activities of visiting and non-club affiliated shooters. Such control is important because these shooters are often the cause of conflict between wildfowlers and other stakeholders in the coastal zone, as is the case within the Moray Firth coastal zone (see Section 4.6.1.1.2).

An example of such control can be seen at the Dyfi National Nature Reserve in Gwynedd, where visitors permits are issued by the Countryside Council for Wales. These are issued

to a maximum of two on Saturdays and four on weekdays, there being no shooting on Sundays in Wales.[236]

8.3.8. Zoning.

Zoning is accepted in many coastal nations as a useful management technique to achieve the aims and objectives of coastal zone management, including conflict management and resolution. Several forms of zoning can be used, including; seasonal, flexible, fixed, voluntary or statutory.[231]

The way zoning can be used to resolve conflicts of use is examined in greater detail in Chapter 9, where a zoning scheme designed to control conflicts of use as well as achieve maximum user satisfaction has been experimentally applied to the Moray Firth coastal zone.

Enforcement mechanisms include policing, wardening, information and education systems, recording technology (e.g. speed cameras) and criminal or financial penalties are also considered in Chapter 9.

Finally, while certain of the above techniques may be appropriate in isolation as a resolution for any identified conflict, it is likely that some combination would be required, especially when issues concerning a number of conflicts are considered together, as they should be to produce a co-ordinated approach to coastal zone management.[231]

Chapter 9: Land and Sea Use Zoning Scheme for the Moray Firth Coastal Zone.

9.1. *Introduction.*

Zoning is accepted in many countries as a useful technique for coastal and sea use management. Peet (1986, cited in Gubbay, 1989), defined it as –"that set of processes whereby the various uses and activities are associated with specific locales and related conditions under which they may or may not be conducted."

Zoning is used to achieve a variety of ends and it can be applied in many different ways. It is most frequently used to control conflicts of use, or to protect or promote a preferred use. Nevertheless, it can have much more general aims such as protecting the water quality of an area or encouraging planned development of a stretch of coastline.[237]

There are many aspects involved in using zoning for management and it is important that careful consideration is given to five main questions before using such an approach:

- What do you hope to achieve using zoning ?
- What activities need to be managed ?
- What are the boundaries (i.e. zone types) ?
- How will a zoning plan be developed in order to produce maximum user satisfaction ?
- How will it be publicised and enforced ?

Each of the above five questions need to be answered with regard to the Moray Firth coastal zone, in order to facilitate the development of a localised zoning plan.

9.2. *What do you Hope to Achieve using Zoning ?*

The most acceptable overall management framework with regard to the coastal zone is one involving multiple use. Within such a framework, few activities are likely to be totally prohibited throughout a region, and restrictions are best kept to a reasonable minimum wherever possible.[195] Nevertheless, experience elsewhere indicates that limited access within at least certain areas is necessary. Specifically, limitation on certain activities are essential if long-term sustainable ecological development of the coastal zone is to be a reality.

Through the establishment of multiple use zones and the implementation of coastal and marine policies, it is possible for entire coastal areas to become zoned. This would comprise areas in which human uses were permitted, for example; fishing, tourism, recreation, residential and commercial development etc, and other areas set aside for research and conservation, and perhaps also other activities.[195]

Within the Moray Firth, the use of zoning schemes is not a new phenomenon. Section 5.3.1 describes how the Firth was zoned for onshore North Sea oil and gas developments in 1974, whilst Figure 5, Section 5.2.4.1 illustrates how Moray District Council has zoned its coastal area with its conservation in mind.

Chapter 6 investigates conflicts of interest between different user groups of the Moray Firth coastal zone. The information obtained, and especially the conflict matrix (Figure 9) drawn up for the Moray Firth, indicate that recreational groups and the natural environment are the most affected categories. They are primarily affected by commercial, military and pollution causing activities. Therefore, the aim of the zoning scheme is to, as far as possible, separate important conservation and recreation areas from areas containing the above affecting activities, thus reducing conflicts between the various user groups of the Moray Firth coastal zone.

9.3. *What Activities Need to be Managed ?*

Chapter 4 outlines the uses and users operating within the Moray Firth coastal zone. These can be divided into six activity groups for the purposes of developing a zoning scheme. The activity groups are; Recreational, Commercial, Infrastructure, Military, Waste Disposal and Collecting. The main activities that make up each activity group are illustrated in Table 45.

9.4. *What are the Boundaries (i.e. Zone Types)?*

In principle, a zoning scheme to control 'n' activities on a simple allowed or prohibited basis could utilise up to 2^n zone types, that is, all possible combinations of allowance and prohibition. If a zoning plan is to be understood by the public though, up to a dozen zone

types appears to be an upper limit in practice.[238] This is because a zoning plan which is not readily understood by the public is difficult to implement and manage.

Zoning plans of one type or another have been developed for coastal and sea use planning in a number of countries throughout the world, these include; Australia, Japan, Sweden, the United States and the United Kingdom. Examples of the zone types used in three zoning schemes are outlined below.

The first example shows the eight zone types that were defined for use within the Cairns section of the Great Barrier Reef Marine Park Authority (GBRMPA):

- Preservation Zone: All activities except essential non-manipulative research are prohibited. This is a maximum protection zone.
- Scientific Research Zone: All activities except research and the operation of research stations are prohibited. This is a high protection and low utilisation zone.
- Marine National Park (B) Zone: All activities except research and non-fishing recreation (from small boats) are prohibited. This is a high protection zone but allowing a modest level of non-commercial utilisation.
- Marine National Park (A) Zone: All activities except research, non-fishing recreation, recreational line fishing, and observatory construction are prohibited.
- Marine National Park (A1) Zone: All activities except research, non-fishing recreation, recreational line fishing, observatory construction, and trolling are prohibited.
- General Use (B) Zone: All activities except research, non-fishing recreation, recreational and other line fishing, observatory construction, trolling, netting, and spear fishing are prohibited. That is, trawling and commercial shipping are prohibited. This zone is protected from high impact commercial utilisation.
- General Use (A) Zone: No activities are prohibited. That is, research, non-fishing recreation, recreational and other line fishing, observatory construction, trolling, spear fishing, commercial shipping, and trawl fishing are permitted.
- Seasonal Closure Zone: This zone is comparable to the General Use (B) zone, except that boating and fishing activities can be seasonally prohibited. This zoning allows for the protection of breeding colonies and groups of various species.[238]

The second example comes from the State of Maine's (USA) Shoreland Zoning Project, which provides technical assistance to the towns, cities and plantations of the State to enable them to prepare local plans and ordinances needed to comply with the 1971 Shoreland Zoning Law. Districts suggested by the project guidelines so that each municipality may zone its shoreline in a manner befitting the local area are:

- Resource Protection or Natural Area: This area is the single most important district recommended. It is at the heart of the legislation to protect water quality through shoreland protection. Resource protection or natural areas mostly should be those that if developed are likely to be unsatisfactory in terms of adverse effects, for example, in wetlands or on steep sided areas it would be difficult if not impossible to have an effectively working septic tank and drainage system.
- General Purpose District: For medium intensity uses of generally rural character.
- Urban District: For intensive uses of an urban character.
- Commercial and Recreational District: For medium and low intensity commercial and recreation areas and facilities.
- Fisheries, Agricultural and Forestry Districts: For low intensity uses that are resource oriented.
- Industrial and Commercial District: For intensive uses of heavy industrial and commercial character associated with water oriented industries and commercial port facilities.
- Residential District: For areas of medium intensity housing.

Not all districts need to be used in all communities, but where the current and proposed land activities are appropriate for any of the districts, such a district may be used.[239]

The third example comes form the United Kingdom, and shows the zoning scheme developed by English Nature to protect the Lundy Marine Nature Reserve. Figure 21 over the page illustrates the zone types involved, and Figure 22 shows how these zones have been translated onto a map of the reserve.[240]

The zoning types developed for the Moray Firth coastal zone are shown in Table 45. These were developed with three main aims in mind. Firstly, to conserve the natural

environment of the Firth, secondly, to continue the economic development of the Firth in a sustainable manner, and thirdly, to increase the recreational potential of the Firth.

Figure 21: Zone Types Present within the Lundy Marine Nature Reserve.[240]

	Activity	General Use Zone	Recreational Zone	Refuge Zone	Sanctuary Zone	Archaeology Protection Zone
Recreational	Diving	Yes	Yes	Yes	Yes	No
	Snorkelling[1]	No	Yes	No	No	No
	Swimming[1]	No	Yes	No	No	No
	Spearfishing	No	No	No	No	No
Commercial	Trawling	Yes	No	No	No	No
	Dredging	Yes	No	No	No	No
	Potting	Yes	Yes	Yes[2]	Limited[3]	No
	Tangle nets	Yes	No	Limited[4]	No	No
	Fixed nets	Yes	No	Limited[4]	No	No
Collecting	Group educational excursions	Permit	Permit	Permit	Permit	No
	Scientific research	Permit	Permit	Permit	Permit	Permit

1 The Landing Bay has a snorkel trail, where it is safe to swim or snorkel at low water. There are many hazardous currents and steep cliffs around the island, so seek advice on the island before snorkelling and swimming elsewhere. All these types of activity are undertaken at your own risk.

2 Potting is not encouraged in a 200m zone stretching seaward from high water mark, from Gannets' Rock South to the Landing Bay.

3 You will require a permit for potting between 1 October and 30 June in the Sanctuary Zone. Potting is prohibited within 100m of the low water mark around the Knoll Pins.

4 You can use tangle and fixed nets in only one part of the Refuge Zone and then only if you have a licence. This is the area west of the line running due north on longitude 04°39.5'W between the points 51°10'N and 51°10.5'N (area within dashed line on map), as far as the mean high water mark medium spring tides.

Figure 22: Zoning Plan Map of the Lundy Marine Nature Reserve.[240]

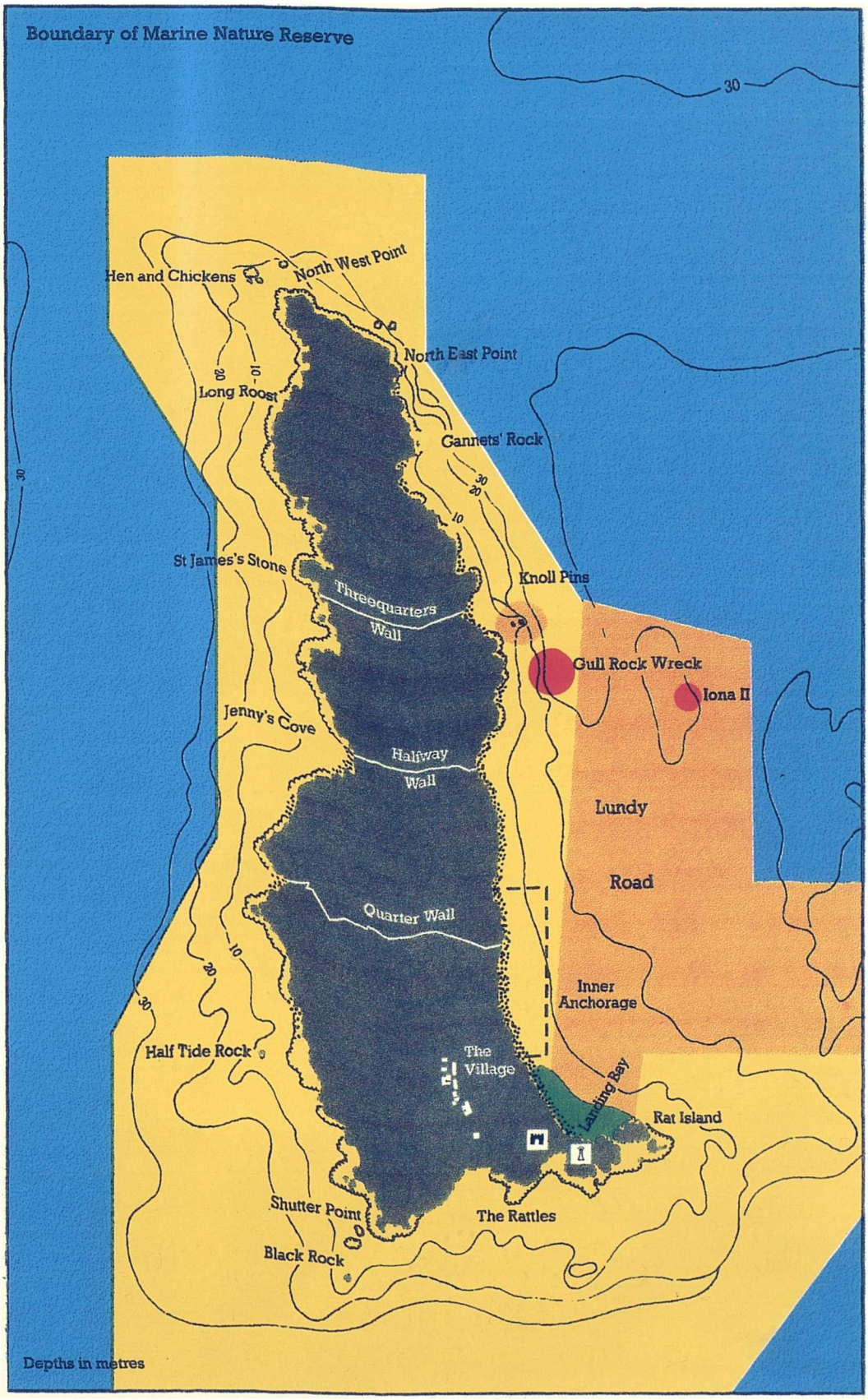


Table 45: Experimental Zoning Scheme for the Moray Firth Coastal Zone.

	Coastal Protection Zones				
Activity	**Preservation Zone**	**Refuge Zone**	**Recreation Zone**	**General Use Zone A**	**General Use Zone B**
Recreational:					
Camping / Caravaning	No	No	Yes	Yes	Yes
Canoeing / Wind Surfing	No	Yes	Yes	Yes	Yes
Golf	No	No	Yes	Yes	Yes
Jet Skiing	No	No	Yes	Yes	Yes
Rambling	No	Yes	Yes	Yes	Yes
Sailing / Yachting	No	Yes (i)	Yes	Yes	Yes
Sea Angling	No	No	Yes	Yes	Yes
Speed Boating / Water Ski.	No	No	Yes	Yes	Yes
Sub-Aqua	No	Yes (i)	Yes	Yes	Yes
Swimming	No	Yes	Yes	Yes	Yes
Wildfowling	No	Yes (ii)	Yes (ii)	Yes (ii)	Yes (ii)
Trial Biking	No	No	No	No	Yes
Commercial:					
Agriculture	No	No	Yes	Yes	Yes
Fish Farming	No	No	No	Yes	Yes
Trawling	No	No	No	No	Yes
Creels / Pots	No	No	Yes (iii)	Yes	Yes
Dredging	No	Yes (iv)	No	Yes	Yes
Industrial Development	No	No	No	No	Yes
Hydrocarbon Development	No	No	No	No	Yes
Aggregate Extraction	No	No	No	No	Yes
Residential Development	No	No	No	Yes	Yes
Port Development	No	No	No	No	Yes
Infrastructure:					
Engineering Works	No	No	Yes	Yes	Yes
Communications	No	Yes	Yes	Yes	Yes
Shipping & Navigation	No	No	No	Yes	Yes
Military:					
Bombing Ranges	No	No	No	No	Yes
Bases	No	No	No	Yes	Yes
Exercise Areas	No	No	No	No	Yes
Waste Disposal:					
Dumping	No	No	No	No	Yes
Effluent Discharge	No	No	No	Yes (v)	Yes
Collecting:					
Scientific Research	Yes (vi)	Yes	Yes	Yes	Yes

Zoning schemes can also add extra limitations on the activities allowed within each zone type (see Figure 21). In Table 45; (i) means that all vessels are asked to avoid anchoring in Refuge Zones whenever possible, (ii) relates to the fact that the majority of wildfowling takes place within the foreshore, and the Crown therefore retains rights by which members

of the public may engage in wildfowling between September 1st and February 20th, (iii) means that creel pot buoys must be brightly coloured and clearly visible at night as well as the day, (iv) relates to mussel dredging in the Dornoch Firth, which is the only area of Refuge Zone where dredge fishing is permitted, (v) means only effluent that has been processed beyond primary treatments can be released into areas categorised General Use Zone A and finally, (vi) means that only non-manipulative research can occur in a Preservation Zone.

9.5. *How will a Zoning Plan be Developed in Order to Produce Maximum User Satisfaction ?*

Ideologically speaking, a good zoning plan is one which reflects the wishes of groups with a right to influence the form of the plan. Largely, this reduces to satisfying user groups demands, but the interests of future generations (by periodically repeating any consultation process), vicarious users, third parties and management personnel also need to be considered. In general terms preparation of a zoning plan involves:

- Identification of interest group demands in relation to the zoning plan.
- Identification of conflicts between interest group demands.
- Producing a plan which satisfies non-conflicting demands and develops a 'best compromise' plan in relation to conflicting demands.

A system of zoning has been developed at the Great Barrier Reef Marine Park Authority (GBRMPA) in Australia, which can be used to achieve the above requirements. This zoning system is known as SIRO-PLAN. The separate steps in the SIRO-PLAN approach to the above matters are summarised below.[238]

9.5.1. Establishing Terms of Reference and Plan-Making Guidelines.

1. Identify; study area boundaries, relevant land use or management regimes, relevant interest groups and their demands, available land use controls and issues needing to be addressed.
2. Develop guidelines (policies) which suggest ways of zoning or managing various categories of land as sensible responses to the demands and issues being addressed.

9.5.2. Data Collection and Generation of Plans.

3. Subdivide the study area into numerous 'mapping units' which will be used, (a) as entities against which data will be collected and recorded, and (b) as entities against which the plan will specify particular land use controls.

9.5.3. Evaluation of Plans.

4. Identify an initial reference plan (assignment of land uses / controls to mapping units), judged to be feasible (not unacceptable) with respects to the extent to which it achieves each policy guideline.
5. Search for a plan which can be judged better than the reference plan in terms of policy achievement. If successful, designate this new plan as the new reference plan.
6. Repeat step 5 until time runs out, or, when no further attempt should be made to improve the reference plan, at which time the reference plan becomes the accepted plan.

9.5.4. Legitimation, Implementation and Updating.

7. Seek interest group objections and incorporate if appropriate.
8. Allocate available resources to tasks required for plan implementation.
9. Monitor interest group demands and issues as basis for deciding when to revise plan.
10. Revise plan at intervals.

There are a number of assumptions on which the SIRO-PLAN method rests. The first is that the 'planning agency' (i.e. organisation or individual) is able to identify the information required in step one of the method. The second is that the planning agency will be able to identify the main demands of major interest groups and interpret these as ideal policy objectives to be satisfied as far as possible by the zoning plan. Thirdly, the method assumes that the planning agency can always choose which ideal policy objectives are satisfied in the two plans. Conversely, this assumption implies that the planning agency will be able to suggest small changes in the relative extent to which ideal policy objectives are satisfied and, if feasible, would improve the plan.

If these assumptions are accepted, the way in which a good zoning plan can be developed becomes apparent. Starting with some initial zoning plan, it could be quite arbitrary

although this is unlikely, the planning agency suggests small changes in the initial plan which, if feasible, would improve the plan. If, on testing, a small change does prove feasible, the slightly changed version of the initial plan replaces the initial plan and becomes the current working version. This process of making small improvements in the working version of the plan can be continued until time runs out, or the planning agency can see no possibility or need of further improvement. Using this method, massive improvement between initial and final plans is frequently possible.[238]

But how does the SIRO-PLAN planning method generate successive small changes in zoning plans ? One of the first steps in a SIRO-PLAN exercise is to subdivide the region being zoned into a large number of small areas called mapping units. A fine mesh of grid cells is an acceptable way of dividing a SIRO-PLAN study area into mapping units.

In step 4 of the exercise, each mapping unit is allocated to a zone type such as Preservation or General Use. Briefly, the selected zone type is the one which gives more overall satisfaction of policy objectives than would be achieved by allocating the unit to any other zone type.

In step 5, the initial map is sent out to user groups (i.e. coastal zone stakeholderes), so that each group can make changes it sees fit in the plan. These altered plans are returned and a new initial plan developed from the input of interest groups. Step 6 sees a continuation of step 5 until time runs out or the planning agency can see no possibility or need of further improvement.

In the SIRO-PLAN procedure, policy objectives are the formal guidelines on which the selection of a zone type for each mapping unit is based. The planning agency hopes to be able to include most of the principles to be used in making zoning decisions within a manageable number of guidelines.

As a matter of expression, policy guidelines which the planner intends to fully implement in the zoning plan usually contain the phrase, –"will be zoned" whereas policy guidelines which the planner realises he / she may not be able to fully implement contain phrases like, –"should, as far as possible, be zoned."

This distinction between black and white or imperative, and grey or indicative policies is an important one. A planning exercise guided by a large number of imperative policies might be infeasible, that is, the guidelines are likely to be contradictory and no plan can satisfy them all. Consider the following examples:

- Policy 1: All islands with seabird nesting colonies will be zoned Preservation.
- Policy 2: All existing resorts will be zoned General Use.

Clearly, islands with both seabirds and resorts cannot be rationally zoned under these policies which commit certain classes of islands, resort or seabird, to certain zone types. An alternative to the imperative policy which committed a class of mapping unit to a zone type is the imperative policy which excludes the possibility of a class of mapping unit being allocated to one or more zone types. For example:

- Policy 1: Islands with seabird nesting colonies will not be zoned General Use.
- Policy 2: Islands with resorts will not be zoned Preservation.

Provided there is a third zone type available, there is clearly a simple solution to the planning problem which satisfies these two exclusive policies.

Just as imperative policies can be usefully divided into exclusion and commitment policies, indicative policies can be divided into preference and avoidance policies. Continuing the previous example, Policy 1 could be expressed as a preference policy thus:

- As far as possible, all islands with seabird nesting colonies should be zoned Preservation.

or as an avoidance policy thus:

- As far as possible islands with seabird nesting colonies should not be zoned General Use.

Thus, preference and avoidance policies are statements indicating what is or is not desired in the zoning plan without insisting that it be totally achieved. These policies express trade-off aspects of the exercise.[238]

9.6. *How will it be Publicised and Enforced ?*

A zoning plan should give users a clear idea of the management decisions for an area, but for it to succeed two aspects are particularly important, publicity and enforcement.

9.6.1. Publicity.

Unless users are aware of the zoning plan it is unlikely to be successful, therefore, people must know of its existence. The first point of contact should be within the development of the zoning plan itself, stakeholders should be involved from the start in consultations and therefore should be well aware of the details of the zoning plan.

Once the consultation process is completed and an acceptable zoning plan has been developed, wider publicity can be achieved via the use of local news papers to explain the plan. The planning agency responsible for developing the plan could also produce their own publication to explain the plan. An example of this is the Poole Harbour Aquatic Management Plan (1994) document produced by the Poole Harbour Steering Group to explain the zoning scheme for the Poole Harbour area.[241]

Actually at the coast, the zoning scheme can be explained to the public via the use of site indicators at access points. For example, zoning notice boards can be used to indicate the specific zone type of an area. These can also included information on the particular activities and zone to which an access point or area relates, the nature and extent of the zone, buoyage, codes of behaviour offshore and onshore, wardening, emergency services, weather forecast sources, tide information, bye-laws applying and arrangements for car parking.

Paper versions of the zoning notice boards could also be made readily available in chandlers, sports shops, pubs, clubs and hotels to promote the existence of a zoning scheme.

Buoys can also be used as site indicators to show the boundaries of particular zones, especially those designed to accommodate different types of water based recreational activity, such as bathing, sailing, windsurfing and jet skiing. Figures 23 and 24 were provided by the Personal Watercraft Association and show how this Association would

like to see recreational zones developed. Figure 23 illustrates the type of buoys the Association would like to see used, while Figure 24 illustrates two examples of how recreational zones could be developed for jet skiers, though the idea could be developed to incorporate other activities.

Figure 23: Recommended High Visibility Marker Buoy for Jet Ski Zone.[114]

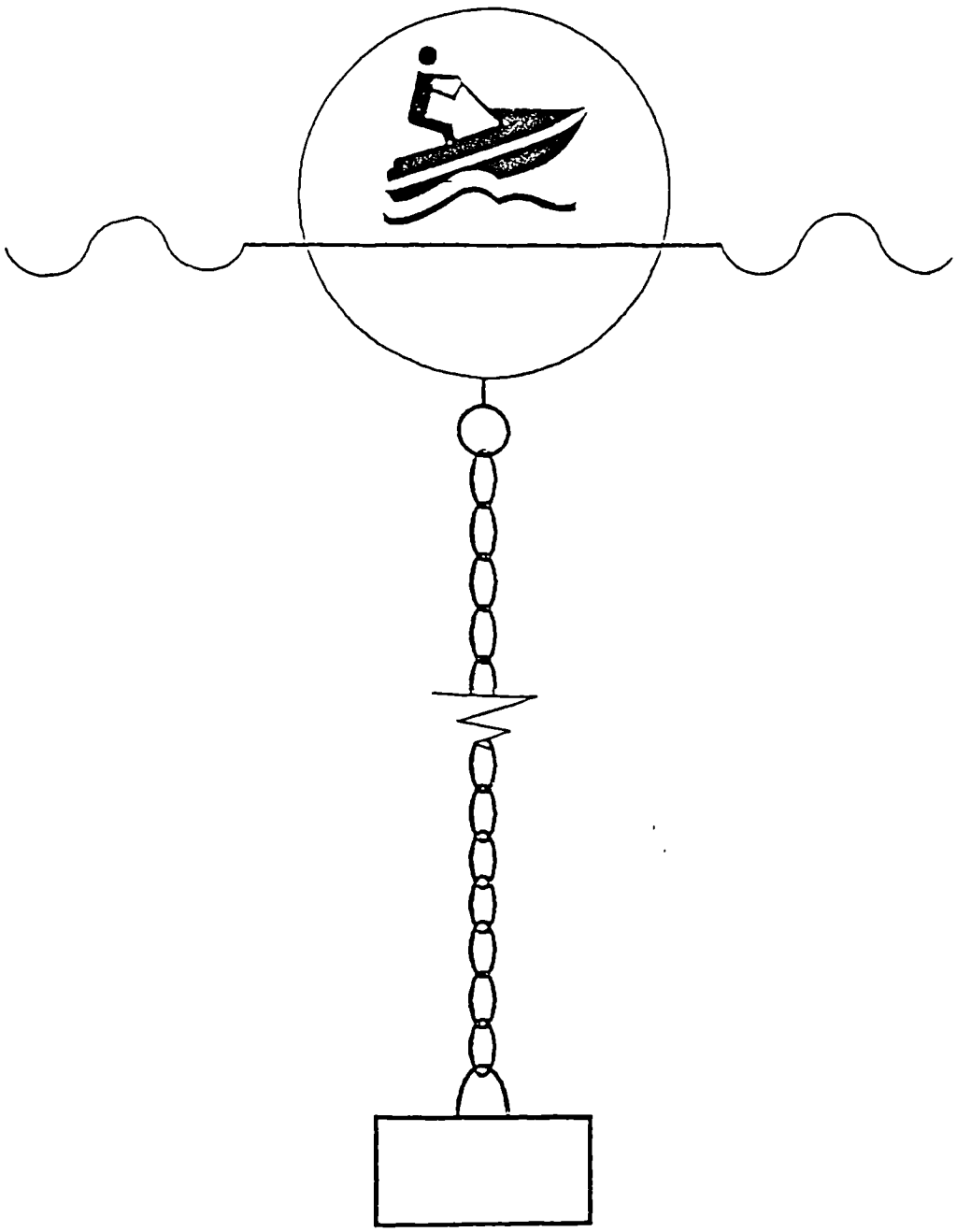
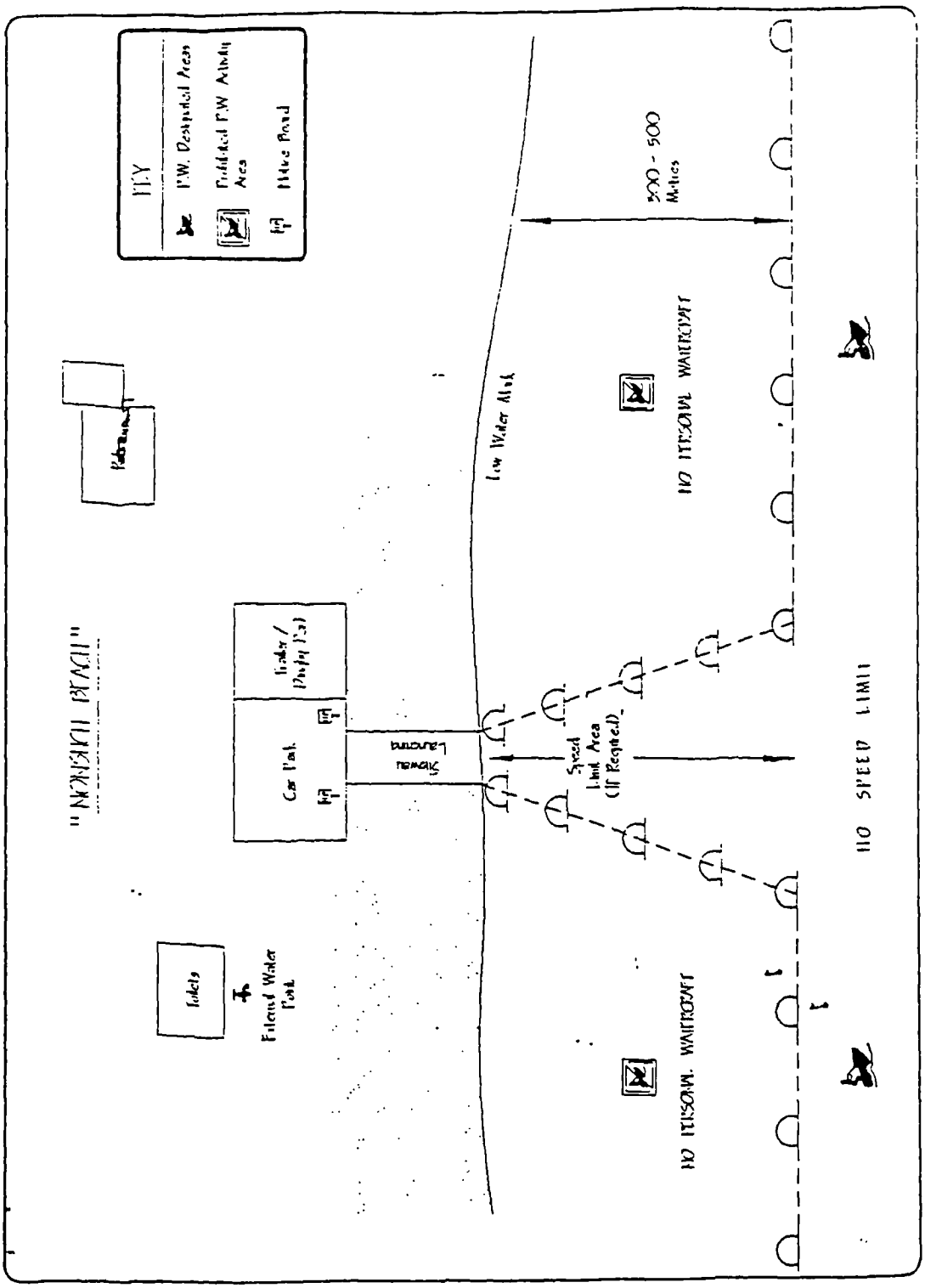
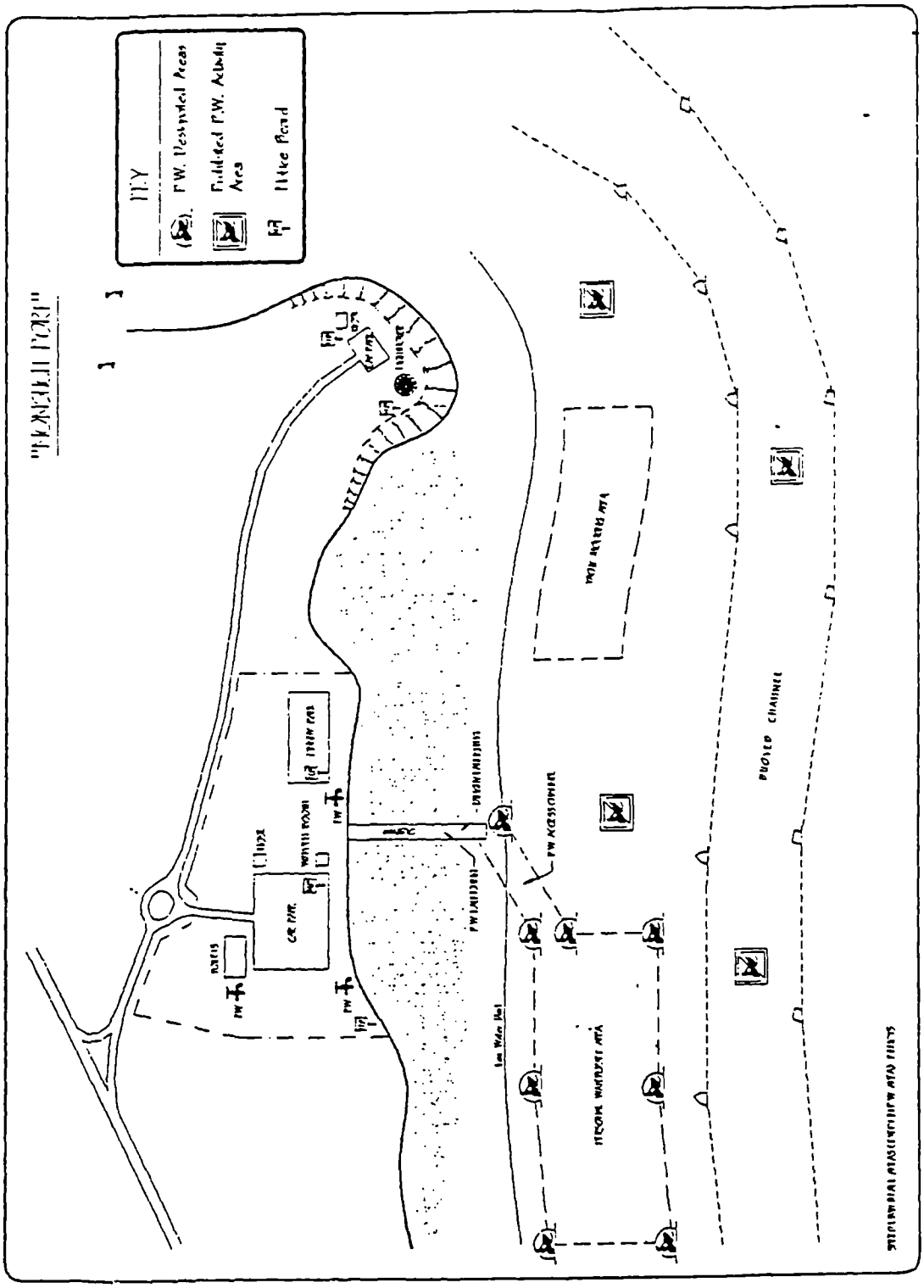


Figure 24: Two Examples of how Buoyage can be used to show the Boundaries of Possible Recreational Zones.[114]





Where it may not be practical, or appropriate, to use site indicators such as notices and buoys to show the boundaries of the zones, chart markings can be used. However, this means it takes longer for zoning to become widely known and any subsequent modifications will take some time to get into circulation.[237]

9.6.2. Enforcement.

The second important aspect concerns enforcement, as well as the legal regime under which enforcement can take place.

From a legal stand point, Planning Authorities would have the legal right to enforce zoning above the low water mark under the auspices of the Town & Country Planning Act (Scotland) 1972. Below the low water mark however, this Act does not apply, therefore the use of voluntary agreements arising from stakeholder negotiation, co-operation and consensus, as well as the powers of individual participants would have to be relied upon, for example, local authority ability to control the use of recreational craft up to 1,000m below the low water mark by making bye-laws under the Civic Government (Scotland) Act 1982. Such bylaws can also set aside areas for bathing, regulate the navigation of all pleasure boats including power boats, water skiers and jet skies, and also regulate there speed and require exhaust silencers to be fitted in order to reduce noise pollution.[133]

As a result of the above legal regime, enforcement of a zoning scheme can be divided into two halves. Firstly, enforcement above the low water mark, which would be very much the passive enforcement that already occurs under the land planning system. In contrast, enforcement below the low water mark would have to be developed, and due to the mobile nature of water based activities, any enforcement would have to be of an active nature.

Zones close to the shore such as recreational zones could potentially be enforced from the shore by volunteer wardens provided by the various sports governing bodies, enforcing codes of practice developed by the governing bodies. Also, the potential for clubs to police their own members and visiting craft and individuals should also be considered. However, the use of club members would require the implementation of a regular training

programme. The use of remote technologies, such as speed cameras, could be utilised by wardens to great effect.

Penalties and a statutory means of enforcing the zones and codes of practice may however need be required if the effectiveness of the zoning, codes of practice and wardening is to be maximised. Fines associated with bye-laws, such as speed limitation bye-laws, could go a long way to fulfilling this requirement.

For maximum effectiveness however, any wardening service would have to be co-ordinated by a dedicated individual under the direct control of the co-ordinating agency, for example, the local authority. His or her duties would include; liaison with the police, liaison with relevant users to resolve conflicts which arise between competing user groups, and user groups and the conservation needs of the environment, to collect together, publicise and arrange distribution of existing codes of practice, to assess any shortcomings of existing codes of practice as guidelines for the conduct of activities along the coast, to organise the distribution of new information to users, and to assess the requirements of coastal zone users in the region and assist in developing support for them.[242]

Enforcement of zones further offshore are harder to organise due to the larger areas that have to be covered, and is therefore potentially much more costly. Elsewhere in the world, light aircraft and patrol boats have been used and can be effective.[237] Within the Moray Firth, fisheries enforcement vessels belonging to the Scottish Office Agriculture and Fisheries Department (SOAFD) and aircraft already patrol effectively, and their role could be widened to encompass enforcement of offshore zones.

9.7. *The Moray Firth and the SIRO-PLAN Technique.*

In order to produce an experimental zoning scheme for the Moray Firth coastal zone, it was decided to roughly follow the steps of the Australian SIRO-PLAN technique. These steps were as follows.

9.7.1. Identification of Relevant User Groups and Participants.

Research carried out for Chapters 4 and 5 identified those individuals, groups, clubs and organisations that would be willing to actively participate in developing an experimental zoning scheme for the Moray Firth coastal zone.

9.7.2. Identification of Policy Objectives and Guidelines.

Policy objectives and guidelines to achieve the aims of the zoning scheme for the Moray Firth coastal zone, which have dictated how the initial reference plan appears are:

- Areas designated as National Nature Reserves will be zoned as Preservation Zones.
- Areas designated as Sites of Special Scientific Interest or Local Nature Reserves as far as possible should not be zoned as General Use A or B.
- All areas designated as Preservation Zones will be separated from General Use A and B Zones by a buffer Refuge Zone.
- As far as possible, avoid zoning areas where recreational activities predominate as General Use B.
- As far as possible, ensure that attractive areas for industrial development on land, and trawling offshore, are zoned General Use B, as General Use B is the only zone type in which industrial development and trawling are permitted. This policy seeks to maximise the areas available for these activities, but not to the detriment of other policies and guidelines.

9.7.3. Subdivide the Study Area into Mapping Units.

As stated previously, the use of a fine mesh of grid cells is an acceptable way of dividing a SIRO-PLAN study area into mapping units. This was done for the Moray Firth coastal zone using the EASY-CAD 3 computer drawing package.

9.7.4. Draw up an Initial Reference Plan which is then sent to Stakeholders.

Appendix 4 shows the Initial Reference Plan that was sent to indentified stakeholders within the Moray Firth area. The Initial Reference Plan itself was constructed by following the above mentioned policy objectives and guidelines, on which the selection of a zone type for each mapping unit is based.

9.7.5. Analysis of the Response of Stakeholders to the Initial Reference Plan.

Several themes emerged from the replies to the Initial Zoning Plan questionnaire (see Appendix 4) that was sent to 39 stakeholders of the Moray Firth coastal zone, whom together it was considered formed a fairly structurally representative survey sample.

One of the main response themes was concerned with the establishment and designation of the Preservation Zone. Several of the survey replies objected to this zone type, with particularly strong rejection coming from wildfowlers within the Moray Firth. Mr A. MacDonald, secretary of the Dornoch and Cromarty Firths Wildfowlers Association went so far as to say that –"the concept of Preservation Zones, within which the majority of activities are banned, flies in the face of current attempts to develop integrated management strategies." Particular concern was expressed at the initial zoning of both Nigg and Udale Bay's within the Cromarty Firth, which were described as prime wildfowling sites, as Preservation Zones, as such zoning would effectively halt wildfowling within the Cromarty Firth.[243]

The Preservation Zone was also questioned by both Highland and Grampian Regional Council's. Concerned was expressed regarding the overall restrictive nature of the zone, especially concerning traditional rights such as those of wildfowling.[244,245]

A solution to the problems raised by the Preservation Zone was offered by Banff and Buchan District Council. This required that the Preservation Zones should be merged with Refuge Zones to include all National Nature Reserves and where possible Sites of Special Scientific Interest under the Refuge Zone type. In this way the less restrictive use requirements of a Refuge Zone could be applied to areas previously identified as Preservation Zones.[246] This would allow for the continuation of traditional rights such as wildfowling, while still providing a degree of protection from more harmful activities such as coastal development and land claim.

Both River Purification Boards contacted expressed concern over the designation of a blanket restriction on sewage and trade effluent discharges and the widespread specification of treatment standards. Both were considered to be over restrictive as they would not take into account the receiving waters local capacity to cope with such discharges. It was considered, that if discharges, especially of effluent, could be treated to an acceptable standard, the Board's must be reasonable in whether or not to allow these even within proposed Preservation, Refuge or Recreational Zones. In addition, it was

considered that the refusal of an application for discharge purely on the grounds that a coastal zone management zoning scheme prohibited such discharges was unlikely to be sustainable on appeal.[247,248]

Unsurprisingly, the Recreation Zone was enthusiastically received by those stakeholders involved in inshore water based recreational activities.[249,206] The separation of activities such as canoeing, diving and jet skiing from predominately commercial activities which were previously identified as being responsible for causing conflicts of use between these user groups was considered most beneficial, especially with regard to safety considerations.[245] The further separation within the Refuge Zone of those types of recreational activities identified as being incompatible, for example, the noise disturbance cause to wildfowlers, canoeists and wind surfers by speed boats and jet skis, was also identified as a further positive aspect of the Initial Reference Plan.[206]

9.7.6. Develop a New Zoning Plan.

From the alterations suggested to the Initial Reference Plan, a new zoning plan can be developed which will be a consensus of all the suggestions made. The major changes made to the Initial Reference Plan as a result of the input from stakeholders includes; the merging of Preservation Zones with Refuge Zones to allow a greater degree of activity access within the areas previously designated as Preservation Zones (therefore the Preservation Zone column is removed from Table 45), the acceptance of effluent discharge within Refuge, Recreational and General Use A Zones if an acceptable standard of treatment, decided upon by the relevant River Purification Board, can be attained (this modification of the Initial Reference Plan is identified by the prefix (v) in the revised Table 45), the extension of the recreational zone from Lossiemouth to Garmouth in accordance with Moray District Councils Coastline Policy ENV8,[245] and finally the addition of facilities that were overlooked within the Initial Reference Plan, these include the MoD bombing range off the coast west of Rosehearty and the MoD bombing range and major pipeline assembly facility upon Morrich More.[244,245]

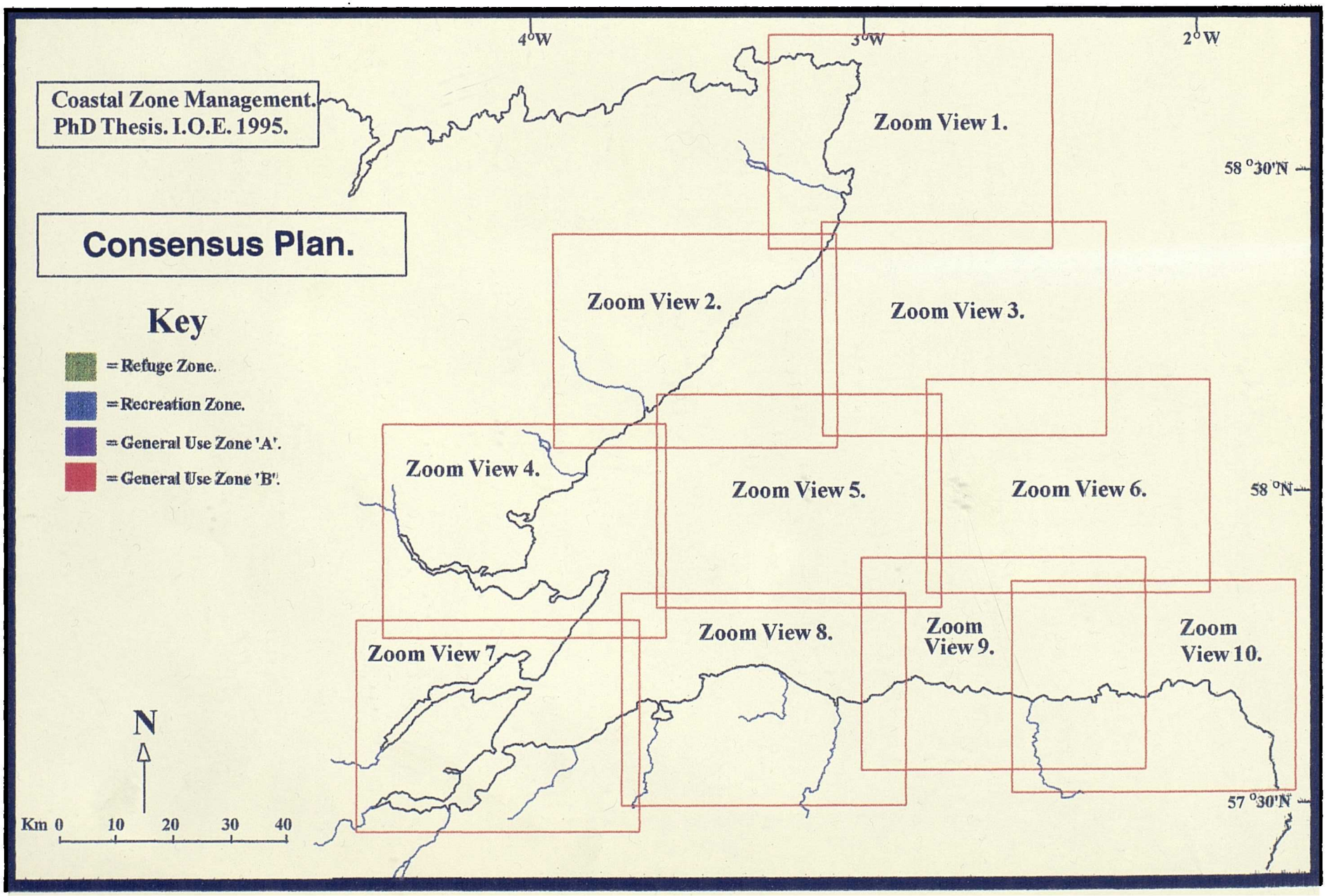
Under normal conditions, this new zoning plan would them be sent out once more to the indentified stakeholders within the Moray Firth. This process of taking on board alternatives, reassessing the zoning plan and then sending the newly altered zoning plan for consultation once more would continue until time ran out or there was no possibility or need for further improvement. However, due to financial constraints on the amount of research that was able to be carried out, such a repeating of the consultation process was unable to be carried out. Therefore, the first set of alterations to the Initial Reference Plan has had to be accepted prematurely as the Consensus Plan proposed for the experimental zoning for the Moray Firth coastal zone. This Consensus Plan is shown in the following twelve pages.

9.7.7. Send the New Zoning Plan out to the Stakeholders for Conformation.

This would normally be the next step in the full development of a zoning plan, however, once again, due to financial constraints the consensus plan has had to be accepted without further confirmation.

9.7.8. Recommend the Time when a Revised Plan will be Required.

The Consensus Plan should be constantly monitored and modifications made when necessary. However, it is recommended that the above consultation process should be repeated every five years, to keep the zoning scheme up to date.


Coastal Zone Management.
PhD Thesis. I.O.E. 1995.
Consensus Plan.
Key
= Refuge Zone.
= Recreation Zone.
= General Use Zone 'A'.
= General Use Zone 'B'.
4°W
3°W
2°W
58°30'N
58°N
57°30'N
Zoom View 1.
Zoom View 2.
Zoom View 3.
Zoom View 4.
Zoom View 5.
Zoom View 6.
Zoom View 7
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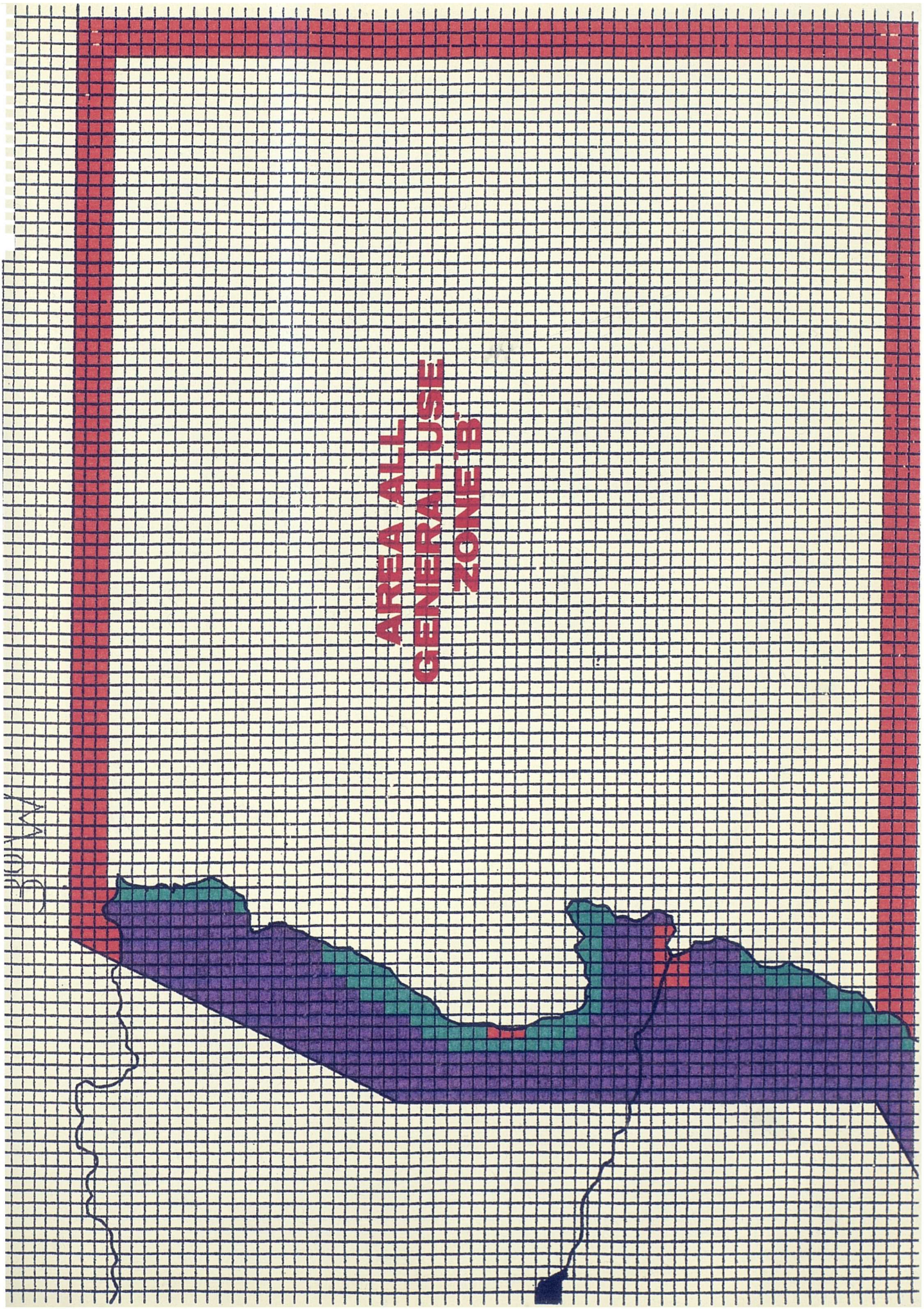
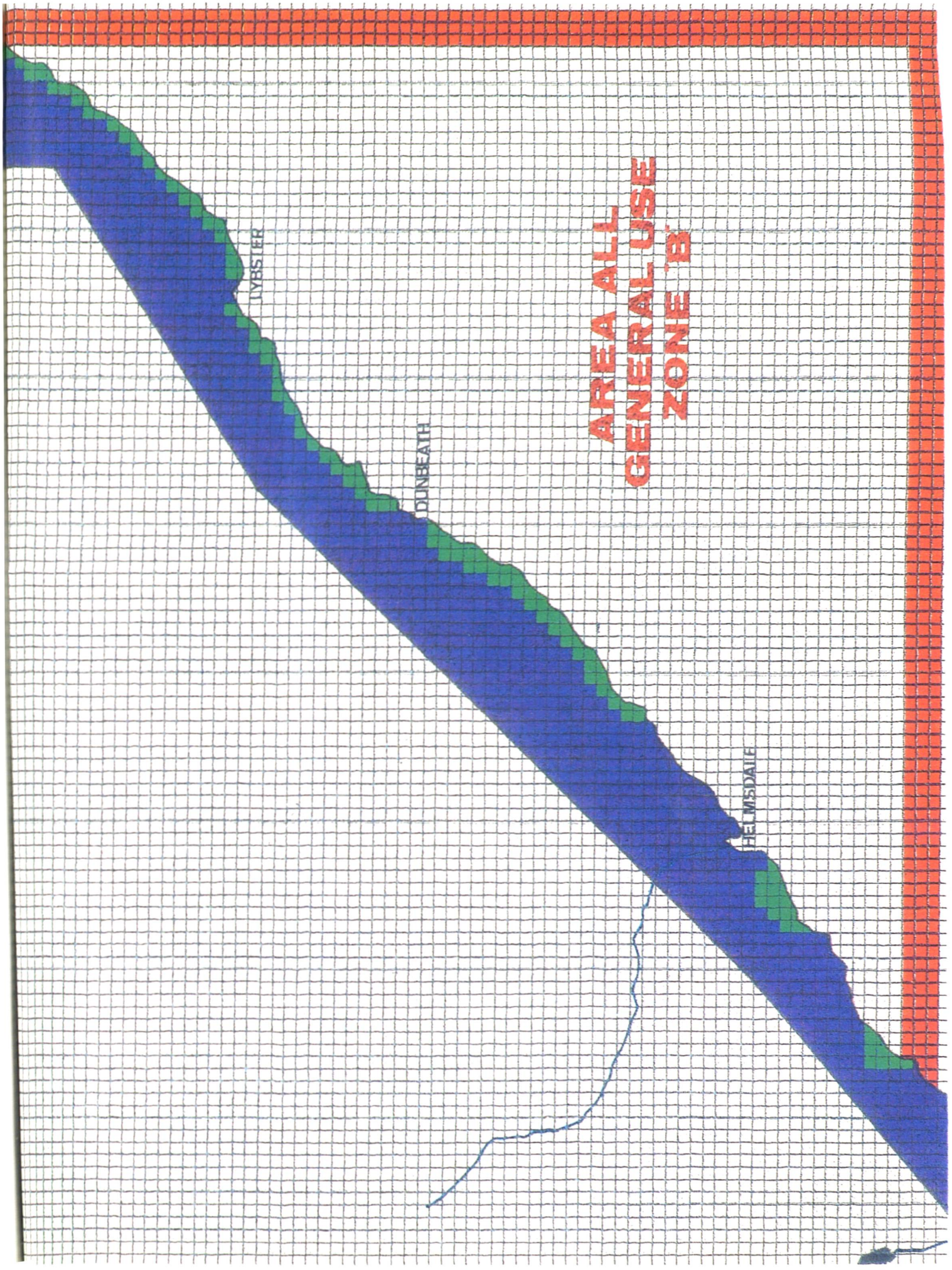
Revised Table 45 as a Result of Initial Reference Plan Stakeholder Consultation

	Coastal Protection Zones			
Activity	**Merged Preservation & Refuge Zone**	**Recreation Zone**	**General Use Zone A**	**General Use Zone B**
Recreational:				
Camping / Caravaning	No	Yes	Yes	Yes
Canoeing / Wind Surfing	Yes	Yes	Yes	Yes
Golf	No	Yes	Yes	Yes
Jet Skiing	No	Yes	Yes	Yes
Rambling	Yes	Yes	Yes	Yes
Sailing / Yachting	Yes (i)	Yes	Yes	Yes
Sea Angling	No	Yes	Yes	Yes
Speed Boating / Water Ski.	No	Yes	Yes	Yes
Sub-Aqua	Yes (i)	Yes	Yes	Yes
Swimming	Yes	Yes	Yes	Yes
Wildfowling	Yes (ii)	Yes (ii)	Yes (ii)	Yes (ii)
Trial Biking	No	No	No	Yes
Commercial:				
Agriculture	No	Yes	Yes	Yes
Fish Farming	No	No	Yes	Yes
Trawling	No	No	No	Yes
Creels / Pots	No	Yes (iii)	Yes	Yes
Dredging	Yes (iv)	No	Yes	Yes
Industrial Development	No	No	No	Yes
Hydrocarbon Development	No	No	No	Yes
Aggregate Extraction	No	No	No	Yes
Residential Development	No	No	Yes	Yes
Port Development	No	No	No	Yes
Infrastructure:				
Engineering Works	No	Yes	Yes	Yes
Communications	Yes	Yes	Yes	Yes
Shipping & Navigation	No	No	Yes	Yes
Military:				
Bombing Ranges	No	No	No	Yes
Bases	No	No	Yes	Yes
Exercise Areas	No	No	No	Yes
Waste Disposal:				
Dumping	No	No	No	Yes
Effluent Discharge	Yes (v)	Yes (v)	Yes (v)	Yes (v)
Collecting:				
Scientific Research	Yes	Yes	Yes	Yes

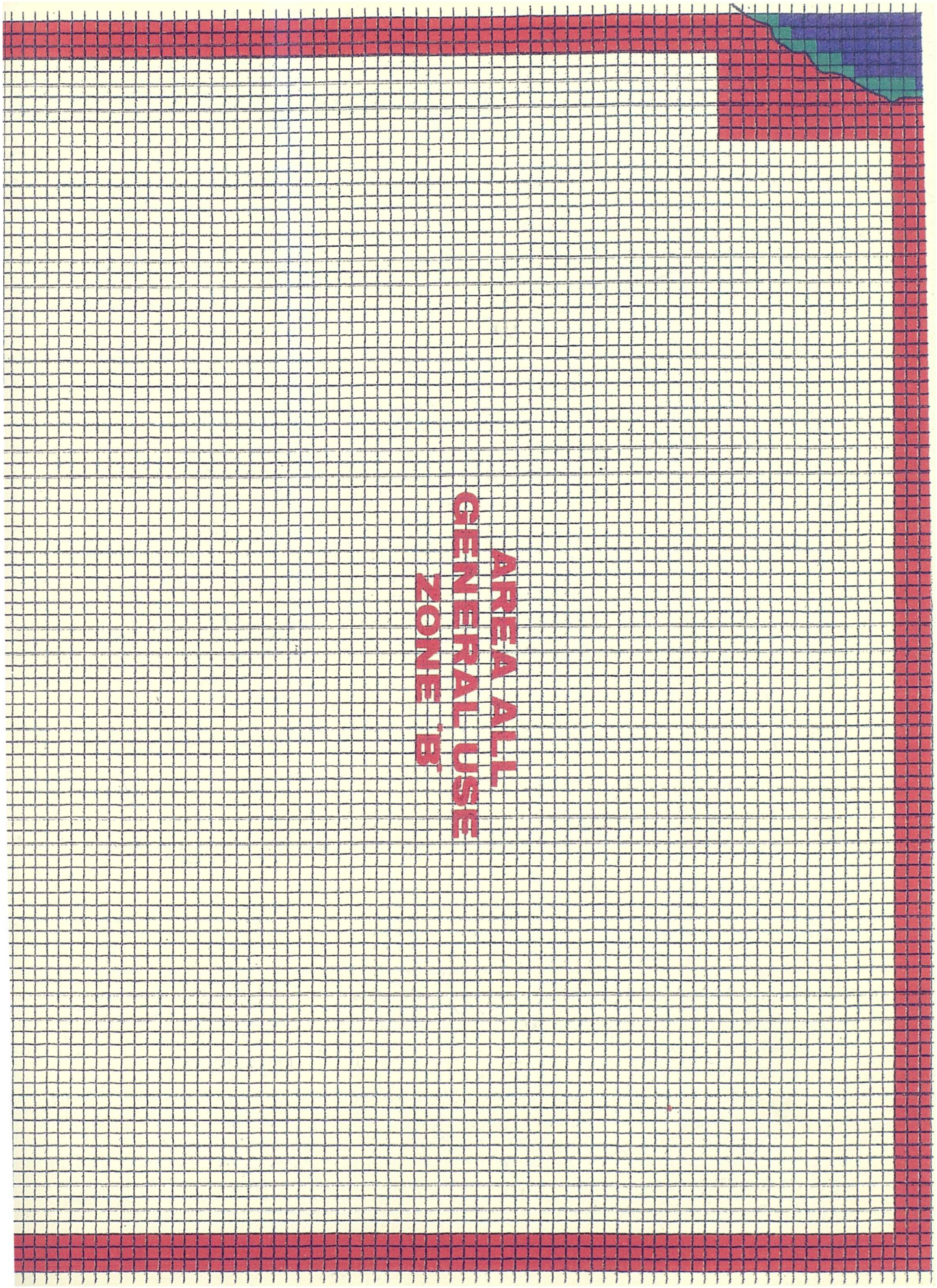
Zoom View 1: Duncansby Head & Wick.



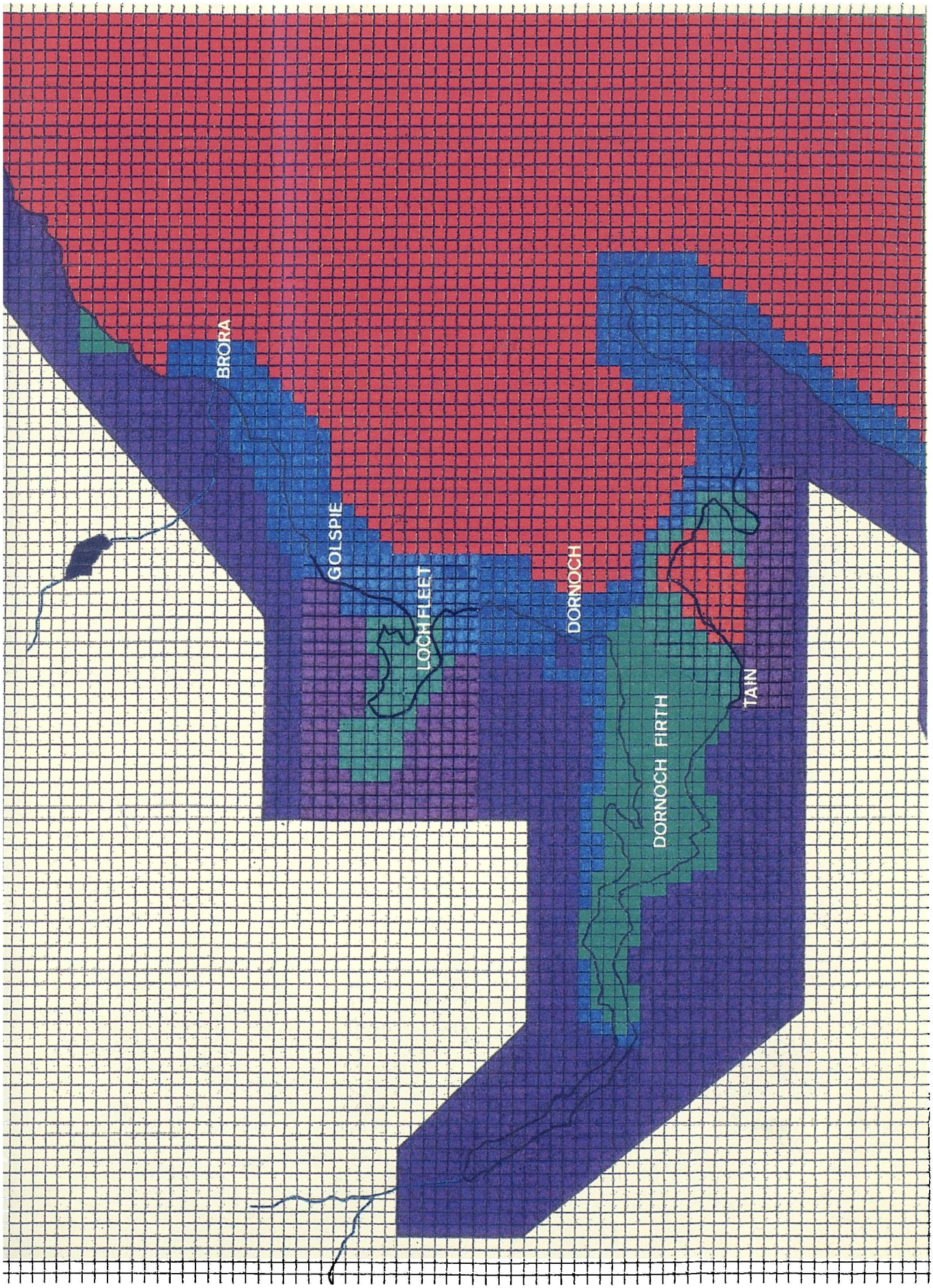
Zoom View 2: Lybster & Helmsdale.



Zoom View 3



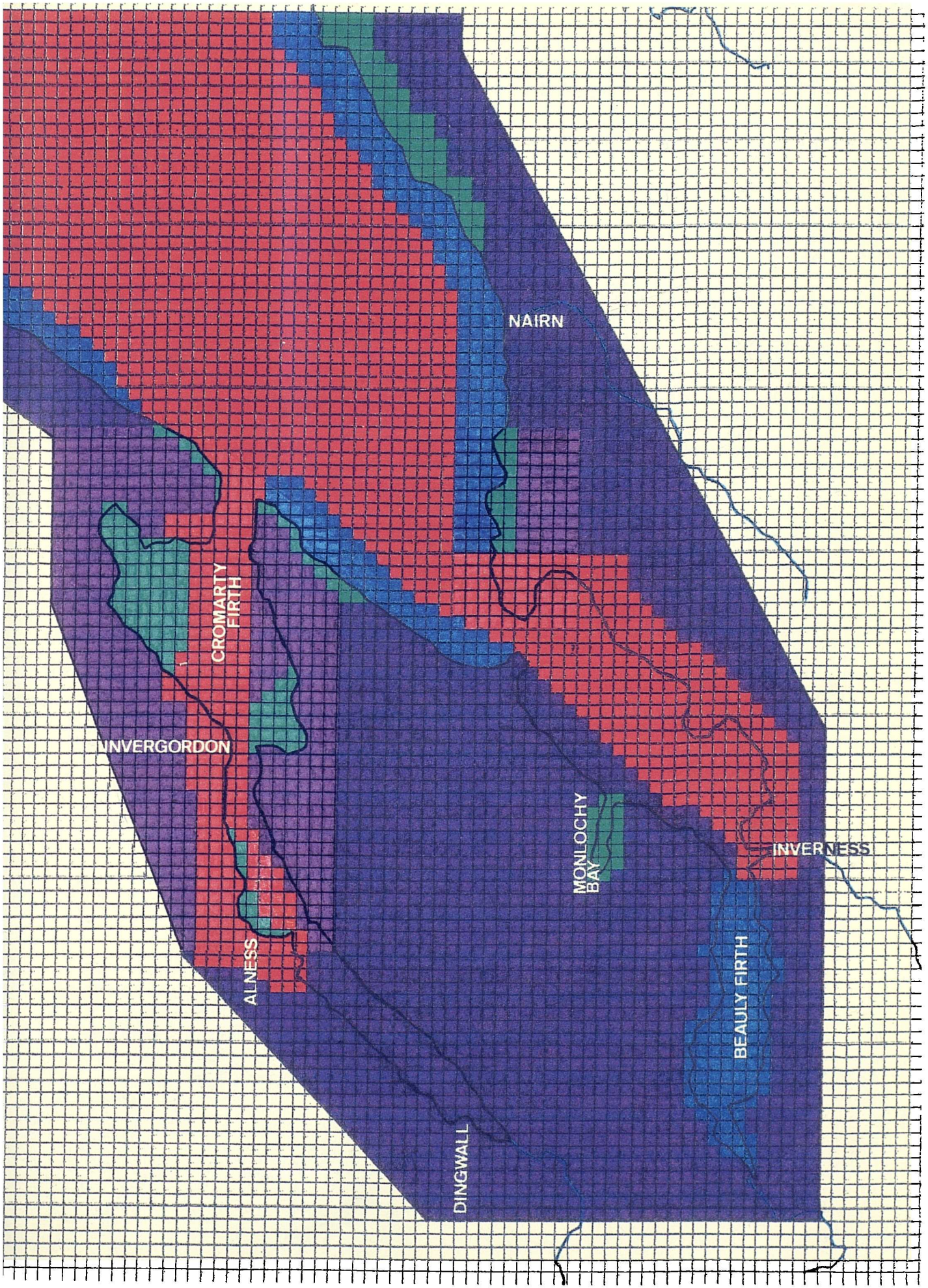
Zoom View 4: Brora, Golspie & the Dornoch Firth.



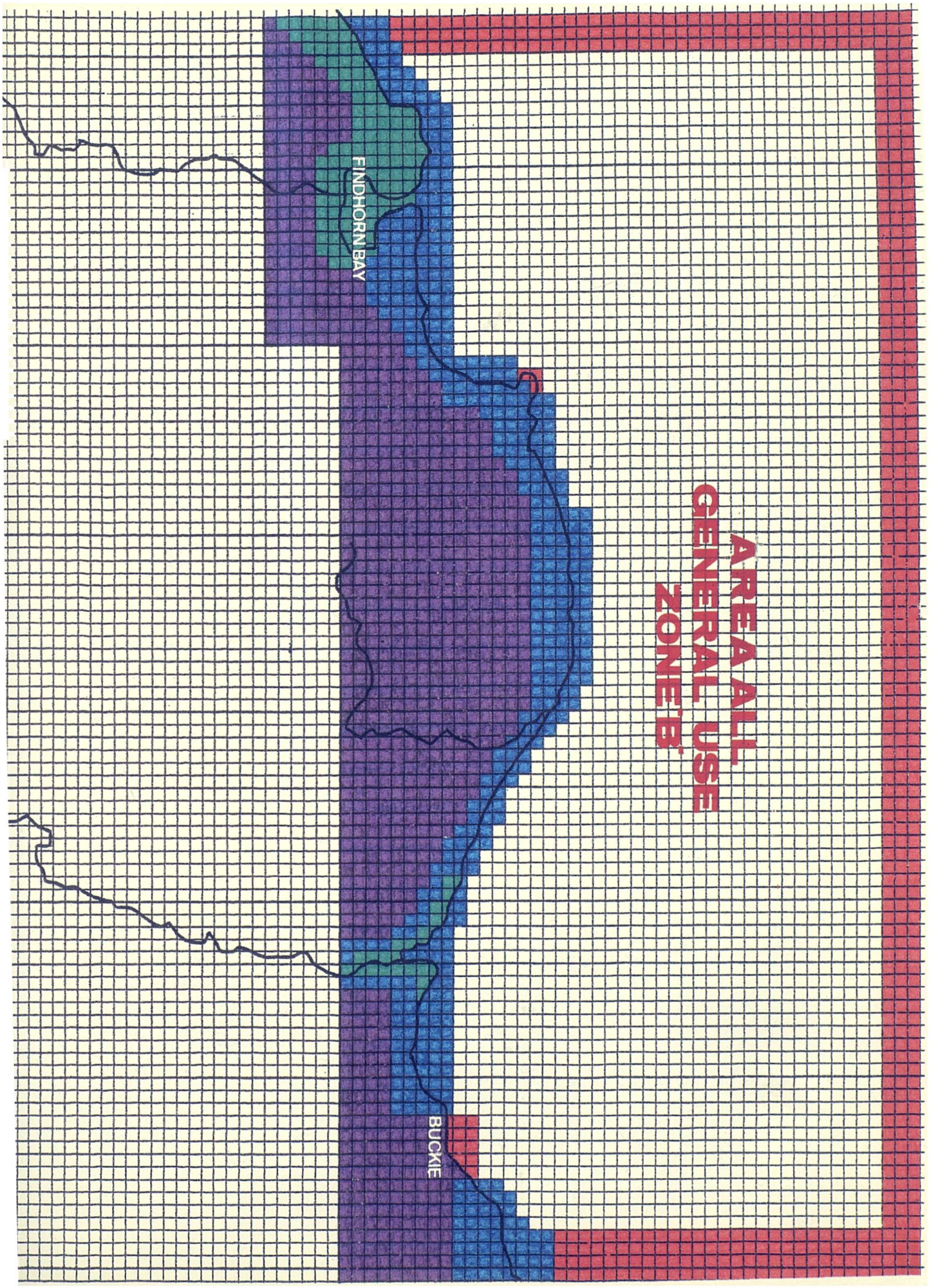
Zoom View 5: Central Moray Firth.

Zoom View 6.

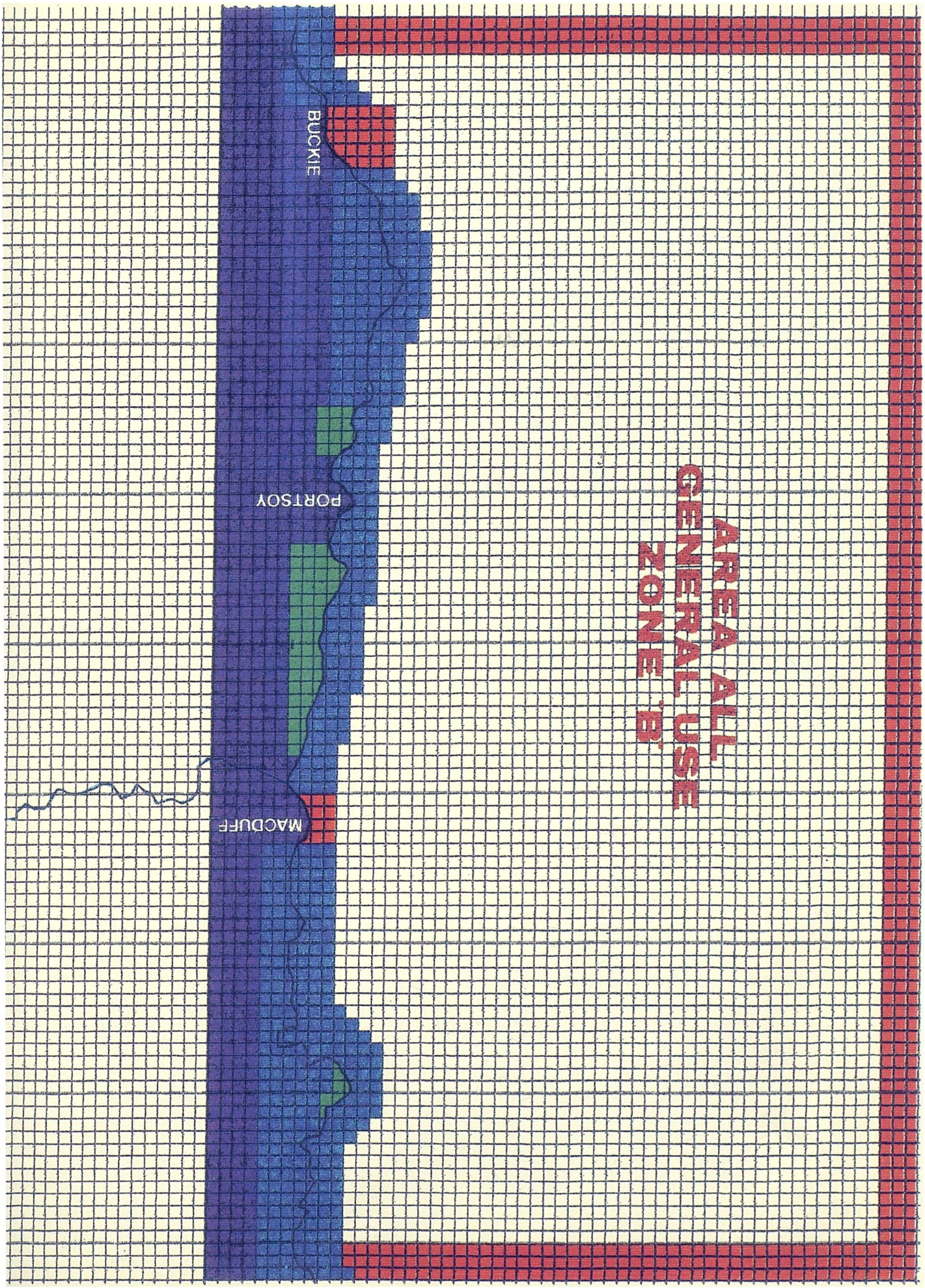
Zoom View 7: Cromarty, Inverness &Beauly Firths.



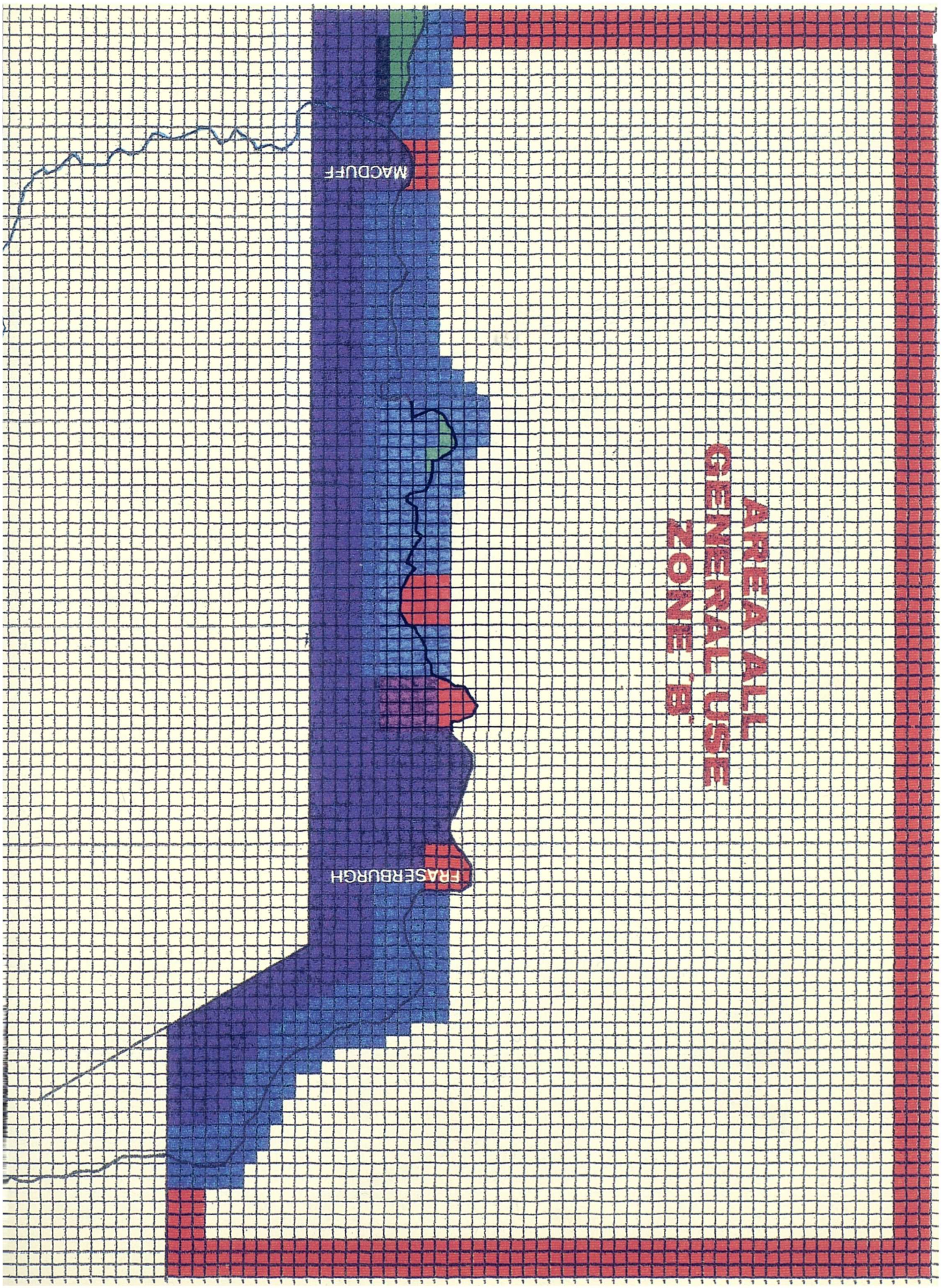
Zoom View 8: Moray District.



Zoom View 9: Western Banff & Buchan



Zoom View 10: Eastern Banff & Buchan.



Chapter 10: Conclusions and Recommendations.

10.1. *The Research in Review.*

This thesis aimed to examine and assess certain general presumptions concerning coastal zone management, and to gain insights into the processes associated with management through the development and rigorous application of a management framework for coastal zone management within a case study area. This involved:

- Selecting a case study area for coastal zone management
- Developing a management framework for coastal zone management
- Applying the management framework to the case study area

As outlined in Section 1.3.1, the Moray Firth coastal zone was selected as the case study area for this thesis. The main reasons for its selection, over and above the fact that the Moray Firth is a recognised and clearly identifiable geographic unit, are also outlined in Section 1.3.1.

The initial concept for the management framework for coastal zone management, identified at the outset, was based on two fundamental principles. Firstly that any efforts to manage the coastal zone must be based on a proper understanding of the processes and characteristics of the coastal zone concerned and secondly, that the process of management should be structurally representative of the coastal zones stakeholders (see Section 7.4.1).

From this initial starting point, the management framework (see Figure 1) evolved fully out of the application of these two fundamental principles of the initial management framework concept within the Moray Firth coastal zone.

The management framework presented in Figure 1 can be divided into four stages. The initial stage is one of 'information gathering' within the coastal zone. The information acquired is then fed into the second stage, the 'management process' which is based on the concept of non-weighted coastal zone stakeholder participation in an attempt to encourage negotiation and co-operation between the different stakeholders with regard to coastal zone issues of concern, for example, coastal zone conflict management and resolution. Stages three and four are derived from the management process. Stage three represents

'management decisions' regarding coastal zone issues of concern, which are reached as a result of stakeholder negotiation and co-operation, while stage four involves the 'implementation and enforcement' of the management decisions 'on the ground'.

The application of the first stage of the management framework, that is, information gathering, within the Moray Firth coastal zone began with a consideration of the abiotic environment. This was considered important as the abiotic environment forms the framework upon which the biotic environment, use and management of the coastal zone are all superimposed. Detailed information was gathered concerning; geology and geomorphology, bathymetry, hydrography and meteorology.

Following on from the above statement concerning the framework role of the abiotic environment, the logical next step involved an examination of the biotic environment of the Moray Firth coastal zone in the form of a description of the major coastal ecosystems, a description which, related again to areas pertinent for both use and management.

The majority of the information concerning the biotic environment of the Moray Firth concentrates on coastal and intertidal areas, with comparatively little available concerning the marine environment. The information that does exist for the marine environment is narrowly focused on top predators such as birds and marine mammals, with very little information regarding the communities and habitats that support these animals.

As a result, the information gathered concerning the biotic environment of the Moray Firth coastal zone consists of a description of; site, benthic environment, ornithology and marine mammals for each ecological unit reviewed. The information presented concerning the pelagic environment is far less site specific, primarily being examined within the context of the outer Moray Firth (see Section 3.1).

The information presented illustrates that the Moray Firth has a great variety of coastal and intertidal habitats, many of which are of national and international importance, including several large and highly productive estuarine systems. Although little is known regarding the habitat diversity of the marine environment, what is known identifies the Moray Firth

as an area supporting nationally and internationally important populations of many top predators including fish, birds and marine mammals.

Following the gathering of information concerning both the physical and natural environments, attention was then turned to the human dimension within the Moray Firth coastal zone. This began with a study of utilisation via an examination of the uses and users of the Moray Firth coastal zone, which was aided by the use of specifically designed survey questionnaires (see Appendix 2). This examination highlighted the perception of the coastal zone as a resource, subject to a wide range of use from an array of often competing users, with often equally competing philosophies with regard to the proper place of the coastal resource within the cultural milieu.[227]

Section 4.1 described how the use of the coastal resource can be divided into three component parts, these being a past, present and future dimension.[20] Such a division was recognised within the pattern of resource use within the Moray Firth coastal zone. That is to say, uses that were identified as 'traditional', and as such have been inherited from the past dimension include; fisheries, waste disposal, ports, coastal settlements and military use. Within the present dimension of coastal use these traditional uses have altered in significance, that is, either declined or risen in importance, often in response to present dimension coastal zone uses. For example, fisheries activity in the Moray Firth has declined significantly with time, while in contrast the activity at ports and the size of settlements have both increased mainly in response to the exploration and exploitation of hydrocarbons which began in the North Sea in the 1970's.

Other present day uses of the Moray Firth coastal zone include; aquaculture development (possibly in response to the decline in fisheries activity), industrial development (again, mostly in response to hydrocarbon developments in the North Sea), recreation and tourism and nature conservation (as a response to the general increased use of the Firth).

As far as the future dimension of coastal resource use within the Moray Firth is concerned, predictions can be made on the basis of trends identified in present day use. These include; the possible continuing decline in fish stocks throughout the North Sea as a whole due to

over fishing and pollution, an uncertain future for aquaculture operations in terms of markets, changing technology and coastal water quality and the possible decline in port and industrial development given the maturity of North Sea oil developments. However, in this case, the potential does exist for the Moray Firth to play a significant role in the development of oil fields off the north and north-west coasts of Scotland.[49]

Areas where increased use is likely to occur in the future may include nature conservation within the coastal zone. Concern for the environment is essentially a luxury good, it increases with wealth. In the future, a more affluent society may therefore place a higher value on the natural environment and be willing to pay more to maintain options for the future. Coastal protection may also play a more integral role in the long-term development and management of coastal areas, particularly in the light of predictions concerning global warming and related sea level rise. However, it is now being accepted that except where life or important natural or man made assets are at risk, natural coastal processes should not be disrupted. Finally, one of the biggest increases in the future use of the coastal resource is expected from recreation and tourism within the coastal zone. As outlined in Section 6.9.1.1, Walker (1992) predicts that future pressures from recreation and tourism within the coastal zone of Scotland will increase as a result of the changing nature of activities. Specifically, the changes are likely to be, recreational pursuits spreading over a wider area, the use of areas for longer periods of the year and increased numbers of people participating in activities on an individual basis.[185]

In a continuation of the study into utilisation of the Moray Firth coastal zone, research turned towards the existing planning and management of use within the Moray Firth coastal zone. Above the low water mark the administration of the coastal zone comes under the auspices of the land planning regime of the town and country planning system. Under this system, Regional and General Planning Authorities in the form of Regional and District Council's produce Regional Reports, Structure Plans and Local Plans to plan, manage and control use within their administrative areas.[118]

At this point questionnaire surveys were used to obtain site specific information concerning coastal planning and management by local government within the Moray Firth

coastal zone (see Appendix 3). The areas covered by the questionnaire were; identification of a coastal zone, administration of the coast, ownership of the coast, existing policies and management, the planning of the coast and problems and conflicts in the coastal zone. The main conclusion that can be drawn from the replies to the questionnaire as a whole was that a dichotomy exists in the Moray Firth with regard to land use planning and management at the coast.

On one side, Highland Regional Council, acting as General Planning Authority for the District's within its administrative area, outlined a commitment to coastal zone management (see Questions E5 and E6, Section 5.4.2.5). However, within the Moray Firth the Councils prevailing approach to the coastal zone was found to lie largely within a concern for wider administrative issues. For example, none of the eight Local Plans the Council produces within the Moray Firth defined any distinct zones at the coast, and only five contained limited guidelines that relate 'implicitly' to the coast (see Question E2, Section 5.4.2.5).

In contrast, the two District Council's of Moray and Banff and Buchan, that made no mention of coastal zone management in their replies, have managed to achieve some of the principles involved in this management concept. These two Council's have for example, distinguished distinct coastal zones within their administrative areas (see Figures 5 and 6), established working groups and management agreements at the coast (see Question D6, Section 5.4.2.4), completed coastal studies and consultation exercises (see Question E3, Section 5.4.2.5) and produced plans and policies which explicitly relate to the coast (see Question E2, Section 5.4.2.5).

However, overall the coastline itself is not a focus holding central stage within the coastal administrations of the Moray Firth (see Question A4, Section 5.2.4.1), rather it is a boundary, administrations end here, they rarely transcend.[20]

Below the low water mark, the administration of the coastal zone was found to be aligned closely with use, or at least with sectorally defined interests. The large number of organisations and agencies involved in management, and the maintenance of professional

and agency domains leading to a general lack of integration both serve to reduce effective knowledge of and response to, the area under management. It has been estimated that there are over 200 organisations and government departments who have some jurisdiction within the coastal zone with the result that users of the marine environment are often confused about who to turn to for advice or permission to carry out an activity.[197] There is a need therefore for a greater degree of communication and co-operation within the process of management below the low water mark, which should serve to rationalise the management regime.

Overall, the examination of the existing planning and management regime within the Moray Firth coastal zone resulted in agreement with the findings of Halliday (1986) almost ten years earlier concerning the administration of the coastal zone within England and Wales. That is, that the present system of administration of the coastal zone both above and below the low water mark, although having some merit, is essentially a sub-optimal solution with regard to the planning and management of the coastal resource and its use.[20]

The final section of the information gathering stage of the management framework related to coastal zone issues of concern. These are issues that any effort to manage the coastal zone has to address, for example, sustainable development, coastal pollution and nature conservation. At this point, the research specifically concentrated on what is often considered to be one of the main issues of concern, encompassing many facets of other coastal issues, coastal zone conflicts of use.

Once again survey questionnaires (see Appendix 2) were used to obtain detailed site specific information concerning conflicts of use between the stakeholders of the Moray Firth coastal zone. This information was used to construct a conflict matrix (see Figure 9) for the Moray Firth coastal zone, which indicated that on a general level the different uses of the Moray Firth coastal zone were split into two competing groups. Firstly, those uses that generally caused conflict within the coastal zone, and secondly, those uses that are generally effected by such conflicts. The information obtained for the Moray Firth indicated that recreational groups and conservation value of the natural environment are

the most effected categories, being primarily affected by commercial, military and pollution causing activities.

The information gathering stage of the management framework developed for coastal zone management fulfilled the requirements of the first principle of the initial management framework concept, that is, that any effort to manage the coast must be based on a proper understanding of the processes and characteristics of the coastal zone concerned. The second principle was that the process of management should be structurally representative of the stakeholders of the coastal zone.

With this in mind, the research moved into the second stage of the management framework, the management process. The first step within the management process was the establishment of general aims and objectives for the management of the coastal zone and the identification of appropriate management response options to achieve these aims and objectives. It was considered important to have aims and objectives that would draw participants into the management process as well as generate the realisation of a common purpose between the participants. To this end, the aims and objectives identified were suggested because they were considered to be wide ranging enough for the participants to easily agree upon, but at the same time able act as a focus for the management of the Moray Firth coastal zone.

The essential management response option identified was that the management framework for coastal zone management must be participative, and that any participative approach adopted should be structurally representative of the stakeholders within the Moray Firth coastal zone. In addition, there must be no explicit or implicit weighting given to any participating stakeholders within the management process.

Several levels of 'public' (see Section 7.4.1) participation were identified (see Figure 18) ranging from high involvement to non-participation.[199] It is the opinion of the author that the partnership level of public participation is the only level capable of obtaining the backing of the various stakeholders of the Moray Firth for the implementation of the management framework for coastal zone management developed for this thesis.

Such a level of participation would facilitate a number of specific objectives which are of importance to coastal zone management. These objectives are described in Section 7.4.2 and include; a safety valve function, education, identification of the publics problems, values and needs, the generation of new ideas, review and comment on proposed management decisions, evaluation of alternatives and conflict anticipation / resolution.[201]

The next step was the identification of a mechanism that would allow a partnership level of public participation and facilitate the above specific objectives. Immediately it was recognised that if a public participation mechanism was to be effective it had to encompass two essential elements, education of the public and a response to the public.[207] That is to say, in order to insure intelligent objective participation the public must understand the nature of the problem, all the possible solutions and the costs of these solutions. Mean while, the management process must be capable of responding to the inputs of the public, and allow for that input to have an impact.[199]

The public participation mechanisms identified included, public meetings, workshops and survey techniques, however, it was recognised that these mechanisms suffered from three main drawbacks. Firstly, an inability to ensure that the public have had an impact on the management process, secondly, no guarantee of structural representativeness and thirdly, an inability to maintain continuous two way communication within the management process. Only one form of public participation mechanism identified fulfilled all the requirements, this was the decision making forum mechanism.

Further investigation of the role of public participation, and particularly decision making forums, with regard to the development of institutional arrangements for coastal zone management, which was identified as the next management response option, was then undertaken.

Within the UK it was recognised that non-statutory management plans are becoming an important element in decision making concerning planning and management within the coastal zone. However, concern was expressed that their present ad hoc nature and overlapping areas of interest may hinder their role in improving the effectiveness of

planning and management within the coastal zone. For example, there is currently no mechanism for co-ordinating different plans covering the same stretch of coast, nor for linking with plans produced in neighbouring authorities.[213]

Therefore, it was recognised that effective coastal zone management must involve a certain degree of perspective at the national, regional and local level. The national level could set consistent objectives and policies for the management of the coastal zone throughout the country. To this end, coastal policy for Scotland is due to be set out in detail in the near future with the publication of a Scottish Office paper entitled "Scotland's Coast."[130] The regional level would allow plans to cover more realistically sized areas and management decisions to reflect regional differences and ensure that planning and management practices were not fragmented, whilst the local level is where problems and solutions discussed at the regional level can be implemented for specific sites, such as estuaries which have particular problems that need concerted action.

At present there are no formally recognised regions for coastal zone management in the UK. However, a Discussion Paper issued by the Marine Conservation Society (MCS) in 1992 entitled "Regions for Coastal Zone Management" recommended a division of the UK coast into 21 regions, of which the Moray Firth was one, defined on the basis of coastal cell structure and then modified in the light of other factors such as environmental, economic and administrative influences.[220] This division of the coast is endorsed by the author, it being recognised as an appropriate system for avoiding fragmented management of the coastal zone at the local level.

Three key requirement to achieving the implementation of the management framework within the Moray Firth at a regional level were identified. These were information, co-operation and negotiation. Once again, information was considered important because only by having a proper understanding of the coastal zone, its processes and characteristics, can issues and priorities relevant to the coastal zone concerned be identified. Once identified it is as a result, ideally, though other methods are available (see Section 8.2), of co-operation and negotiation by those concerned with making management decisions that

such issues and priorities can be addressed in an integrated non-piecemeal fashion, avoiding fragmentation, isolation and possible conflicts.[221]

In a continuation of the investigation into decision making forums, it was considered that a multi-organisation of some form might prove appropriate. Such an organisational structure would be capable of drawing together a wide range of coastal interests with a view to the co-ordinated management of the coast, but at the same time allow the coastal zone to remain the responsibility of the individual participants. The extra dimension of management decision making within the coastal zone created would therefore merge with the existing administrative structure and avoid many of the problems associated with the creation of a new agency.

Specifically, it was considered that this would involve the establishment of a regional coastal forum for the Moray Firth that would act as an 'umbrella' mechanism to deal with issues affecting the coastal zone within the region. Such a forum should be a voluntary multi-disciplinary based partnership of individuals and organisations who wish to have a say in the future of the Moray Firth. The organisational structure suggested was a Core Management Group, Secretariat and Topic Groups, formed as and when required.

To be effective, and fulfil the second principle of the initial management framework concept mentioned previously, the Core Management Group must be structurally representative of the stakeholders of the Moray Firth forming the body of the forum, thus representing a balanced range of interests and user groups around the Firth. To this end, a feasible structurally representative composition for a Core Management Group was suggested.

The Secretariat is an individual who acts as secretary and co-ordinator for the Forum, and is often the instigating force behind the establishment of the Forum.

Topic Groups would be set up to tackle specific coastal issues of concern or progress various initiatives, as and when required by the forum. Such groups would ideally comprise representatives of different organisations, specific interest groups, and / or individuals with specific expertise and knowledge of the topic in question. Their findings

would be published in Topic Papers which would provide information for the Core Management Group to help shape future management and planning decision making, and enlighten members to a variety of viewpoints.[218] Advantages of such a structure include:

- The participation of all those involved in the coastal zone, resulting in wide acceptance and successful implementation of management decisions.
- The easier exchange of knowledge and expertise, and greater consensus building between groups of people who may more normally work in opposition to each other.
- A greater ability to influence attitudes and behaviour.
- Using the combined body of local knowledge and expertise of the coastal management group or forum to widen support for sustainable economic use and coastal zone management.[221]

The fourth stage of the management framework for coastal zone management is the implementation and enforcement of management decisions at the local level which take regional policies into account, as well as the national perspective. As mentioned above, the management process proposed has no direct statutory authority, rather it relies on consensus and agreement for voluntary actions, as well as the powers of the participating authorities. As a result of this, the implementation and enforcement of management decisions will principally depend on the commitment of the members of the coastal forum, that is; landowners, local communities, existing organisations and other agencies.[203]

At this point however, it must be stressed that the existence of 'appropriate' managerial forums is unfortunately no guarantee of appropriate management. Experience with similar groups and forums within the USA has shown how they can be usurped and used as an extended power base by financially and politically strong sectoral interests. To avoid this, it is important to establish a separate identity for the forum, generate the realisation of a common purpose (aims and objectives) and ensure that a balance exists between contributing interests (structural representativeness, with no explicit or implicit weighting).

Following the application of the four stages of the management framework within the Moray Firth coastal zone, an assessment of the ability of the management framework to

address coastal zone issues of concern was undertaken. Specifically, this involved the continuation of the earlier information gathering stage concerning the identification of actual and potential conflicts of use within the Moray Firth, with attention now focused on the ability of the management framework to facilitate their management and acceptable resolution.

A range of possible suitable strategies for coastal zone conflict management were identified, and expressed as a mountain to be climbed (see Figure 20). The first step to achieving co-operative management and the resolution of conflicts was identified as bringing stakeholders within the coastal zone into the management process.[228] Identified as being invaluable to this was the development of a multi-disciplinary based, structurally representative coastal forum, due to the ability of such a forum to provide a unique setting within which individual and professional isolation can be broken down. Within such an environment, individuals representing many different coastal zone interests can meet, explain their perspectives as well as raise issues and awareness with regard to specific conflicts of use. From such a dialogue it may be possible for parties involved in conflicts to act together on specific issues of concern identified, that is, collaborate in a co-ordinated manner in an attempt to achieve a satisfactory resolution to the conflict between them.

However, it is not always possible to resolve conflicts between stakeholders simply by bringing them into the management process and relying on informal communication, therefore, alternative arrangements are necessary for this eventuality.[229] That is to say, when co-operation is threatened with collapse, or more likely, if it has yet to be achieved, remedial measures are needed to keep the stakeholders within the management process. Such remedial measures were found to include; confrontation, legislation, arbitration, mediation, facilitation and negotiation.

Of these, negotiation was identified as the most satisfactory method of achieving agreement concerning conflicts between stakeholders, since both parties retain their original objectives as desirable value positions, but recognise that there are constraints which prevent these being reached and so accept that a value position must be sought

which although sub-optimal is still satisfactory.[230] As a result, conflict management decisions reached via negotiation prove far more binding to all concerned than those that may arise out of the other strategies, and are therefore easier to implement and enforce.

However, it is not sufficient to simply reach agreement in principle regarding conflicts between stakeholders, decisions have to be translated into actual working resolution measures 'on the ground'.[231] Such measures already in place within the Moray Firth coastal zone to tackle often high profile conflicts include; codes of practice, development controls, bye-laws, information and education exercises and equipment and quota controls. Others measures include facility provision, access allocation and zoning.

Therefore, the assessment of the management framework continued through an analysis of its ability to develop a zoning scheme for the Moray Firth coastal zone to control conflicts of use as well as achieve maximum user satisfaction. Five main questions were identified as requiring to be answered within the application of a management framework if zoning is to be used successfully for management purposes.

The first question was, "What do you hope to achieve using zoning ?" This was answered by the information gathering stage of the management framework that concentrated on the investigation of coastal zone conflicts of use within the Moray Firth. As a result of this investigation, the overall aim of the zoning scheme was identified as far as possible to separate important conservation and recreation areas from those activities, and areas containing those activities, that are responsible for causing conflicts of use, that is, primarily commercial, military and pollution causing activities.

The second question was, "What activities need to be managed ?" Again the information gathering stage of the management framework provided the answer to this question. This time, the study into the utilisation of the Moray Firth enabled the uses and users of the coastal zone to be divided into six activity groups for the purposes of developing a zoning scheme. These six groups were; recreational, commercial, infrastructure, military, waste disposal and collecting.

The third question was, "What are the boundaries (i.e. zone types) ?" This was the only question that was not specifically answered as a result of the application of the management framework within the Moray Firth coastal zone. As a result of following the SIRO-PLAN system of zoning, the answer to this question was obtained as a result of consensus developed between the stakeholders of the Moray Firth through structurally representative participation. Therefore, the zone types developed at the start were to a certain extent arbitrary, relying on the authors judgement, but became more relevant as a result of stakeholder participation within the management framework.

The fourth question was, "How will a zoning plan be developed in order to produce maximum user satisfaction ?" The key to achieving maximum users satisfaction was identified as achieving consensus between stakeholders who would be affected by a zoning plan. It was suggested that such consensus could arise as a result of full structurally representative stakeholder participation within the management process stage of the management framework developed for coastal zone management. The most appropriate organisational structure identified for this stage of the framework was a decision making Moray Firth Coastal Forum. However, in the absence of such a Forum, questionnaires (see Appendix 4) were sent out to a structurally representative cross section of Moray Firth stakeholders previously identified as a result of the information gathering stage of the management framework.

By following the steps of the SIRO-PLAN technique, alterations to the initial reference zoning plan were achieved as a result of stakeholder participation, resulting in a greater degree of consensus within the new zoning plan that was developed. This consensus included the rationalisation of the zone types as well to the distribution of the zones within the Moray Firth. Although, due to a lack of time and finance, the technique could not be extended to involve several rounds of participation, the first round proved that the management framework, even using a sub-optimal management process organisational structure (i.e. questionnaires in place of a decision making forum) is capable of developing consensus between stakeholders and obtaining user satisfaction concerning the development of a zoning scheme.

The fifth and final question was, "How will it be publicised and enforced ?" In essence the management framework is based on the voluntary participation of stakeholders, therefore, it is feasible that many of the management decisions reached concerning the development of a zoning scheme could be implemented and enforced at the local level on a voluntary basis. However, this is not always possible, therefore, the implementation and enforcement of management decisions would rely, as outline previously, on the existing powers of individual participants. For example, local authority bye-laws to enforce recreational zones up to 1,000m below the low water mark. The fundamental difference from the existing administrative system of planning and management within the coastal zone is that the implementation of management decisions would be occurring in a co-ordinated non-piecemeal fashion, with the backing of the coastal zone stakeholders, that avoids the problems of fragmentation, isolation and possible conflicts.

Several of the stakeholders that were contacted and took part in the zoning exercise expressed the view that zoning was not a suitable technique for the management of the Moray Firth coastal zone, or at least, not for the entire area of the Moray Firth. This may or may not be true, and it was recognised that some zone types held more promise than others, for example, the recreational zone was well received. However, the zoning exercise was not undertaken specifically to develop a zoning scheme for the Moray Firth coastal zone. Instead it was undertaken to test the effectiveness of the management framework to deal with coastal zone issues of concern such as conflicts of use, and reach workable management decisions to mitigate these issues. To this end, it is believed that the management framework has proved its worth as a means of achieving, with little disruption to the existing system of planning and management, the effective co-ordinated management of the Moray Firth coastal zone.

10.2. *Recommendations Arising from the Research.*

Two key recommendations arose from the application of the management framework within the Moray Firth coastal zone. Both are related to the two fundamental principles

upon which the management framework for coastal zone management developed for this thesis was based.

10.2.1 Recognition of the Importance of the Moray Firth Coastal Zone.

This first recommendation recognises the importance of the human dimension of management within the coastal zone. Awareness of the critical importance of the Moray Firth coastal zone for economic, environmental and social reasons needs to be increased amongst the stakeholders of the Moray Firth coastal zone, that is, the users of the coastal zone and those professionals currently charged with the management of the region (see Section 7.4.1).

Education is vital to this process, only by achieving increased comprehension and a more accurate understanding of the processes and characteristics of the Moray Firth coastal zone, can the area be managed sympathetically as a particularly dynamic system.

Education can promote an awareness of the importance of the Moray Firth amongst the public at large. This is important because many of the existing management initiatives at the coast within the Moray Firth come from either a regional or local level of administration and management, for example, the proposed Local Nature Reserve at Findhorn Bay is a Moray District Council initiative. Public opinion is therefore an essential underlying force, it fuels such action and is the body to which such action is ultimately accountable.[20]

Education can also change professional attitudes within the coastal zone, by breaking down barriers to information exchange, reducing isolation between sectorally divided management units and providing such units with an awareness that coastal problems need to be solved through co-operation, rather than confrontation. However, the process of contribution must not be seen to threaten the professional integrity of the contributors, but rather increase the effectiveness with which they can discharge their own responsibilities.[20]

Information is fundamental to this process, as more informed decision making should make for better decision making. Therefore, a complete coastal resource and activity inventory is crucial to well informed and up to date management decision making. The

Crown Estate guidelines for fish farming (see Section 5.7) highlight this need for collated information on all coastal activities. In order to consider other coastal interests in siting fish farms, for example, there must be a detailed, up to date and reliable information base which includes not only coastal activities in the area but also socio-economic, physical and ecological details which also influence resource use.

Within the Moray Firth coastal zone there is a requirement still for essential information concerning the coastal resource. Areas where there is a lack of information include; processes and inter-relationships within the marine environment, comprehensive base-line data for all areas and the interaction of coastal processes and characteristics with use.

Much information relating to the Moray Firth coastal zone is, however, already in existence but is not adequately disseminated. For example, much unpublished data exists concerning the Moray Firth coastal zone which is often difficult and time consuming to obtain, or is held 'in confidence'. Resources are therefore wasted in duplicating the learning process.

In part this lack of dissemination reflects the lack of an appropriate system which would allow the quick and easy transfer of information. For example, no mechanism exists for drawing together research commissioned by private and public agencies which could contribute to the more detailed knowledge of the Moray Firth, or more detailed knowledge of particular coastal problems. Therefore both public and private organisations have a vital responsibility to contribute data, because without complete and detailed data, management decisions become much less meaningful and effective.

There is a need therefore, for a coastal data bank or information retrieval system concerning the Moray Firth coastal zone that would draw together published and unpublished research. At its most basic an information system provides access to data through some form of referencing, traditionally, this is through an index system to an archive of records and documents. The alternative is to use some form of computer database to store and retrieve information. For coastal studies a convenient and relatively

quick approach is to establish a geographic information system (GIS) linking maps with a database.

The processes and characteristics, resources and the uses we make of the coast all have a clear spatial dimension. By using a geographic information system (GIS), it is possible to describe real world objects in terms of their spatial description (point, line, area), their attributes (name, value, classification) and their relationship with other objects (topological relationship). As a basic data retrieval tool a GIS can be used to find where items are, what an item is, or to obtain a summary of all occurrences of an item. However, the real advantages are gained from the analytical capabilities offered. The tool can be used for classification, by comparing different data sets to seek patterns or combinations which suggest some form of relationship. By starting with known problems or phenomena one can adopt an inductive approach to seek general relationships. Finally it is possible to start with an accepted principle and see if this can be substantiated by the available data.[8]

Although GIS is still a relatively new tool in coastal zone management applications, it has been widely applied in a range of studies. These studies, however, only serve to illustrate the potential. For the proposed approach to succeed and justify both the initial set-up and subsequent maintenance costs, such tools must form an integral part of routine management. They must therefore be available for use by those responsible for the day to day management of the coast. Success will depend on well designed systems, appropriate training and a commitment to regional rather than local management.

In addition to mechanisms for gaining access to, and analysing information, the problem also exists of institutional and perceptual barriers to communication and hence to co-ordinated management of the coastal zone. Such barriers to communication within the Moray Firth were recognised as being three fold. Firstly, there is a lack of communication between professionals charged with the planning and management of the area, secondly, and more importantly, there is also a lack of communication between these professionals and the different users of the Moray Firth coastal zone and thirdly, there is a lack of communication between the different users of the Moray Firth coastal zone themselves.

It is the sectoral nature of planning and management within the coastal zone that acts as a barrier to communication between professional managers. Authorities, organisations and agencies involved in planning and management both above and below the low water mark, because of the desire to maintain or reinforce autonomy, preserve traditional areas of singular expertise, consolidate the integrity or value of a profession, tend to be reluctant to cede control. This includes making information available. Information is a strategic weapon in the power stakes of the coastal zone, it could however be a far more effective weapon if resources were pooled.[20] Attitudes therefore lie at the bottom of what is also a structural problem.

Communication between managers and users of the Moray Firth coastal zone is hindered as a result of the level of 'public' participation that occurs in the planning and management of the coastal zone. At the moment, the level of public participation in the present system of planning and management within the coastal zone is the consultation level. At this level, users views are heard but there is no assurance they will be heeded. The author advocates that the correct level of public participation required for coastal zone management is one that allows for an increased degree of decision making power. As stated previously, the partnership level of public participation allows the public to negotiate and engage in trade-offs with traditional powerholders in the coastal zone. This level of public participation is also characterised by two way communication between users and planners and managers of the coastal zone.[199]

Finally, the lack of communication between the different users of the Moray Firth is primarily a result of the lack of an appropriate organisational structure within which different stakeholders can meet and engage in informal communication.

Increased communication between the different stakeholders of the Moray Firth coastal zone was identified as a priority if the sustainable use of the Moray Firth coastal zone as a resource is to be achieved. A step in the right direction are the recent conferences and workshops held within the Moray Firth, taking the coastal zone as their focus, for example, the Scottish Wildlife Trusts annual series of open meetings entitled 'Future Firths'. These

represent a hopeful sign in the gradual emergence of better informed stakeholders of the Moray Firth coastal zone, more aware of the requirements of others and the nature of the coastal resource, and hopefully more aware of the need for communication.

10.2.2. Establishment of a Structurally Representative Moray Firth Coastal Forum.

This second recommendation recognises that the existing system of management within the Moray Firth coastal zone makes the implementation of the main points of the first recommendation, which were; education, information, participation, communication and co-operation, difficult to achieve.

Previous studies such as Halliday (1986) found that the existing sectoral organisation of the coastal zone, although having some positive aspects such as the explicit articulation of view points and the concentration of expertise, prevented the effective co-ordinated management of the coastal zone. The existing sectoral organisation was also identified as restricting the flow of information between agencies, as well as directing the search for solutions to coastal problems at an individual rather than participatory level.

Therefore, there is a requirement for a management framework more in tune with the present day requirements of the coastal zone. However, at the same time it must be recognised that the new can not expect to efface the old, and therefore, any organisational solution to the problems of the coastal zone must seek to harmonise with the existing complex administrative inheritance.[20]

The establishment of a voluntary, non-statutory Moray Firth Coastal Forum was identified as the organisational solution that would allow the management framework for coastal zone management developed for this thesis to function within the confines of the existing sectoral administration of the Moray Firth coastal zone. Specifically, such a forum should be structurally representative of the stakeholders of the Moray Firth coastal zone, so that all facets of coastal zone use and administration are included. In addition, there should be no explicit or implicit weighting given to any participating stakeholder within the process.

The coastal forum itself would act as a constructive problem solving environment, that would serve to break down the barriers to communication identified in Section 10.2.1, and

charge the user with a degree of decision making power. This is important because it is they that are best able to assess the specific requirements for coastal zone management since they themselves would be most affected by any management decisions.

The information required to make management decisions would be provided by the stakeholders themselves, for example, inputs concerning pressures and conflicts within the coastal zone would be vital to the creation of workable and relevant management decisions concerning coastal zone conflicts of use.

Since the forum is a non-statutory body, the implementation of management decisions relies on consensus and agreement for voluntary actions and the powers of the participating authorities. However, in many instances the use of voluntary measures is preferable, even where statutory powers are available, since this suits more comfortably the coastal forum ethos. In this way, the coastal forum allows the establishment of a management framework for coastal zone management which is able to integrate into the existing administrative structure of the coastal zone, while at the same time enabling the effective co-ordinated management of the coastal zone.

10.3. *Conclusion.*

This thesis has shown that the Moray Firth coastal zone is crucial to the region for both economic and environmental reasons. Yet the relentless growing pressures and conflicts exerted on this zone by the numerous user interests is threatening both its economic and environmental value.

It is widely agreed that coastal zone management is required to address such coastal problems, and in doing so achieve sustainable economic development at the same time as maintaining conservation value. However, difficulties lie in applying this principle to coastal locations 'on the ground'.

Previous studies such as Parks (1981) recognised that the existing administrative arrangements concerning planning and management within the coastal zone are finding it more and more difficult to cope with the complex interdisciplinary and ecological problems that occur within the coastal zone environment. Therefore, calls have been made

for a more effective management framework capable of meeting the challenges presented by this special environment.[250]

The management framework for coastal zone management developed for this thesis was based on two fundamental principles. Firstly, that any effort to manage the coast must be based on a proper understanding of the processes and characteristics of the coastal zone concerned, and secondly, that the process of management should be structurally representative of the stakeholders of the coastal zone.

The application of these two fundamental principles within the Moray Firth coastal zone has illustrated that they are capable of forming the basis of a management framework for coastal zone management that, in contrast to previous suggestions made concerning coastal zone management within the UK, for example; coastal zone management legislation and 'super agency', the extension of local government planning powers below the low water mark, the emergence of the Crown Estate Commissioners as a active management agency and the encouragement of 'local' coastal forums, can more effectively achieve many of the requirements of this management concept, these include:

- Generating and disseminating information concerning the processes and characteristics of the coastal zone.
- Increasing public participation from a consultation to a partnership level.
- Increasing communication between and awareness of coastal zone stakeholders.
- Reaching management decisions concerning coastal zone issues of concern such as conflicts of use.
- Implementing and enforcing management decisions.
- Ultimately achieving the effective co-ordinated management of the Moray Firth coastal zone.

Therefore, it is considered that these two principles, forming the basis of the management framework developed for this thesis, have much to recommend them, and the management framework, as essential requirements for the implementation of coastal zone management within the other twenty coastal regions identified around the UK by the Marine Conservation Society in 1992 (see Figure 19).

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Appendix 1: Species List.

This first appendix lists both the common names and scientific names of all the species referred to in the main text.

English Names.	*Scientific (Latin) Names.*
Green Algae.	
Green seaweed spp.	*Prasiola stipitata*
	Cladophora rupestris
	Enteromorpha intestinalis
	Enteromorpha compressa
Brown Algae.	
Cuvie kelp	*Laminaria hyperborea*
Sea oak	*Halidrys siliquosa*
Sugar kelp	*Laminaria saccharina*
Red Algae.	
Red seaweed spp.	*Callophyllis laciniata*
	Ceramium rubrum
	Cladostephus spongiosus
	Dilsea carnosa
	Furcellaria lumbricalis
	Gigartina stellata
	Laurencia pinnatifida
	Membranoptera alata
	Odonthalia dentata
	Plumaria elegans
	Plumaria plumosa
	Ptilota plumosa
Other Algae.	
Sand-binding algae	*Audouinella floridula*
Flowering Plants.	
Ash	*Fraxinus excelsior*
Alder	*Alnus glutinosa*
Annual seablite	*Suaeda maritima*
Birch spp.	*Betula pendula*
	Betula pubescens
Blood-drop emlets	*Mimulus luteus*
Bog pondweed	*Potamogeton polygonifolius*
Bog rush spp.	*Schoenoplectus tabernaemontani*
Bottle sedge	*Carex rostrata*
Brown bent grass	*Agrostis canina*
Carnation grass	*Carex panicea*
Common sedge	*Carex nigra*
Common spike rush	*Eleocharis palustris*
Cord-grass	*Spartina anglica*
Cotton-grass	*Eriophorum angustifolium*
Couch-grass	*Agropyran repens*
Crowberry	*Empetrum nigrum*
Curved sedge	*Carex maritima*
Devil's bit scabious	*Succisa pratensis*
Dutch rush	*Equisetum hyemale*

Eel-grass spp.	*Zostera angustifolia*
	Zostera noltii
Few-flowered spike rush	*Eleocharis quinqueflora*
Fiorin	*Agrostis stolonifera*
Glasswort	*Salicornia europaea*
Grassy pondweed	*Potamogeton obtusifolius*
Great reedmace	*Typha latifolia*
Hairy heather	*Calluna vulgaris*
Jointed rush	*Juncus articulatus*
Juniper	*Juniperus communis*
Lesser butterfly orchid	*Platanthera bifolia*
Lesser twayblade	*Listera cordata*
Lyme grass	*Elymus arenarius*
Marram grass	*Ammophila arenaria*
Marsh bedstraw	*Galium palustre*
Marsh marigold	*Caltha palustris*
Marsh ragwort	*Senecio aquaticus*
Marsh cinquefoil	*Potentilla palustris*
Meadowsweet	*Filipendula ulmaria*
Moonwort	*Botrychium lunaria*
Mountain everlasting	*Antennaria dioica*
Mud rush	*Juncus gerardii*
Narrow blysmus	*Blysmus rufus*
Northern fen orchid	*Dactylorchis purpurella*
Pennywort	*Hydrocotyle vulgaris*
Purple milk vetch	*Astragalus danicus*
Red fescue	*Festuca rubra*
Red rattle	*Pedicularis palustris*
Reed	*Phragmites communis*
Remote sedge	*Carex remota*
Sand sedge	*Carex arenaria*
Sand spurrey	*Spergularia marina*
	Spergularia media
Scots gentian	*Gentianella amerella septentrionalis*
Scots pine	*Pinus sylvestris*
Scurvy-grass	*Cochlearia officinalis*
Sea arrow-grass	*Triglochin maritima*
Sea aster	*Aster tripolium*
Sea centaury	*Centaurium littorale*
Sea club rush	*Scirpus maritimus*
Sea milkwort	*Glaux maritima*
Sea plantain	*Plantago maritima*
Sea poa	*Puccinellia maritima*
Sea rush	*Juncus maritimus*
Sea thrift	*Armeria maritima*
Slender-leaved pondweed	*Potamogeton filiformis*
Small pondweed	*Potamogeton berchtoldii*
Soft rush	*Juncus effusus*
Spring vetch	*Vicia lathyroides*
Tassel pondweed	*Ruppia maritima*
Tufted hair-grass	*Deschompsia cespitosa*
Various-leaved pondweed	*Potamogeton gramineus*
Willow	*Salix spp.*
Yorkshire fog	*Holcus lanatus*

Lower Invertebrates.

Breadcrumb sponge	*Halichondria panicea*
Hydroid (Sea firs spp.)	*Dynamena pumila*

Purse sponge spp.	*Grantia compressa*
Annelids.	
Borring worm	*Capitella capitata*
Catworm spp.	*Nephtys hombergii*
	Nephtys caeca
	Nephtys cirrosa
King ragworm	*Nereis virens*
Lugworm	*Arenicola marina*
Paddle worm spp.	*Phyllodoce maculata*
Ragworm	*Nereis diversicolor*
Sand worm	*Scoloplos armiger*
Spirorbid worm spp.	*Spirorbis spp.*
Less common Annelid spp.	*Aktedrilus monosperme*
	Ammotrypane aulogaster
	Cochlodesma practuenue
	Fabricia sabella
	Leuconia barbata
	Malacoceros fuliginosa
	Ophelia cluthensis
	Ophelia limacina
	Peloscolex benedeni
	Pholis gunnellus
	Polyclinum aurantium
	Pygospio elegans
	Retusa alba
	Spio filicornis
	Spiophanes bombyx
	Travisia forberi
	Tubificoides benedini
Molluscs.	
Baltic tellin	*Macoma balthica*
Bivalve mollusc spp.	*Thracia phaseolina*
Common cockle	*Cerastoderma edule*
Common limpet	*Patella vulgata*
Curled octopus	*Eledone cirrhosa*
Great scallop	*Pecten maximus*
Edible mussel	*Mytilus edulis*
Laver spire shell	*Hydrobia ulvae*
Oval piddock	*Zirfaea crispata*
Pacific oyster	*Crassostrea gigas*
Pearl bubble	*Retusa obtusa*
Peppery furrow shell	*Scrobicularia plana*
Queen scallop	*Aequipecten opercularis*
Rough periwinkle	*Littorina saxatilis*
Sand gaper	*Mya arenaria*
Squid spp.	*Alloteuthis subulata*
	Loligo forbesi
Tellin spp.	*Tellina fabula*
Thin tellin	*Tellina tenuis*
Crustaceans.	
Acorn barnacle	*Balanus balanoides*
Amphipod spp.	*Haustorius arenarius*
	Bathyporeia pilosa
Barnacle spp.	*Verruca stroemia*
Broad-clawed porcelain crab	*Porcellana platycheles*

Edible crab	*Cancer pagurus*
Lobster	*Homarus gammarus*
Norway lobster	*Nephrops norvegicus*
Sand shrimp	*Corophium volutator*

Echinoderms.

Brittlestar spp.	*Acrocnida brachiata*
Common brittlestar	*Ophiothrix fragilis*
Common starfish	*Asterias rubens*
Scarlet starfish	*Henricia oculata*

Fish.

Atlantic salmon	*Salmo salar*
Butterfish	*Pholis gunnellus*
Cod	*Gadus morhua*
Common eel	*Anguilla anguilla*
Flounder	*Platichthys flesus*
Haddock	*Melanogrammus aeglefinus*
Halibut	*Hippoglossus vulgaris*
Herring	*Clupea harengus*
Lemon sole	*Microstomus kitt*
Mackerel	*Scomber scombrus*
Monkfish	*Squatina squatina*
Plaice	*Pleuronectes platessa*
Rainbow trout	*Salmo gairdneri*
Saithe	*Pollachius virens*
Sandeel	*Ammodytes tobianus*
Sprat	*Sprattus sprattus*
Whiting	*Merlangius merlangus*

Birds.

Arctic skua	*Stercorarius parasiticus*
Arctic tern	*Sterna paradisaea*
Atlantic puffin	*Fratercula arctica*
Barnacle goose	*Branta leucopsis*
Bar-tailed godwit	*Limosa lapponica*
Black guillemot	*Cepphus grylle*
Black-headed gull	*Larus ridibundus*
Black-tailed godwit	*Limosa limosa*
Blue tit	*Parus caeruleus*
Brent goose	*Branta bernicla*
Buzzard	*Buteo buteo.*
Canada goose	*Branta canadensis*
Capercaillie	*Tetrao urogallus*
Coal tit	*Parus ater*
Common gull	*Larus canus*
Common sandpiper	*Actitis hypoleucos*
Common scoter	*Melanitta nigra*
Common snipe	*Gallinago gallinago*
Common tern	*Sterna hirundo*
Cormorant	*Phalacrocorax carbo*
Corn bunting	*Miliaria calandra*
Curlew	*Numenius arquata*
Dunlin	*Calidris alpina*
Eider duck	*Somateria mollissima*
Fulmar	*Fulmarus glacialis*
Gadwall	*Anas strepera*
Gannet	*Sula bassana*

Glaucous gull	*Larus hyperboreus*
Goldeneye	*Bucephala clangula*
Golden plover	*Pluvialis apricaria*
Goosander	*Mergus merganser*
Greater black-backed gull	*Larus marinus*
Great skua	*Stercorarius skua*
Great tit	*Parus major*
Green sandpiper	*Tringa ochropus*
Greenshank	*Tringa nebularia*
Greylag goose	*Anser anser*
Grey phalarope	*Phalaropus fulicarius*
Grey plover	*Pluvialis squatarola*
Guillemot	*Uria aalge*
Herring gull	*Larus argentatus*
Kestrel	*Falco tinnunculus*
Kittiwake	*Rissa tridactyla*
Knot	*Calidris canuta*
Lapwing	*Vanellus vanellus*
Lesser black-backed gull	*Larus fuscus*
Linnet	*Carduelis cannabina*
Little turn	*Sterna albifrons*
Little stint	*Calidris* spp.
Long-tailed duck	*Clangula hyemalis*
Mallard	*Anas platyrhyncha*
Mute swan	*Cygnus olor*
Oystercatcher	*Haematopus ostralegus*
Pink-footed goose	*Anser fabalis brachyrhynchus*
Pintail	*Anas acuta*
Pochard	*Aythya ferina*
Purple sandpiper	*Calidris maritima*
Razorbill	*Alca torda*
Red-breasted goose	*Branta ruficollis*
Red-breasted merganser	*Mergus serrator*
Redshank	*Tringa totanus*
Ringed plover	*Charadrius hiaticula*
Ruff	*Philomachus pugnax*
Sanderling	*Calidris alba*
Sandwich tern	*Sterna sandvicensis*
Scaup	*Aythya marlia*
Scottish crossbill	*Loxia scotica*
Shag	*Phalacrocorax aristotelis*
Shelduck	*Tadorna tadorna*
Skylark	*Alauda arvensis*
Spotted redshank	*Tringa erythropus*
Teal	*Anas crecca*
Tufted duck	*Aythya fuligula*
Turnstone	*Arenaria interpres*
Twite	*Carduelis flavirostris*
Velvet scoter	*Oidemia fusca*
Wheatear	*Oenanthe oenanthe*
Whimbrel	*Numenius phaeopus*
White-fronted goose	*Anser albifrons*
Whooper swan	*Cygnus cygnus*
Wigeon	*Anas penelope*
Wren	*Troglodytes troglodytes*
Yellowhammer	*Emberiza citrinella*

Mammals.

Atlantic white-sided dolphin	*Lagenorhynchus acutus*
Bottlenose dolphin	*Tursiops truncatus*
Common dolphin	*Delphinus delphis*
Common seal	*Phoca vitulina*
False killer whale	*Pseudorea crassidens*
Grey seal	*Halichoerus grypus*
Harbour porpoise	*Phocaena phocaena*
Humpback whale	*Megaptera novaeangliae*
Killer whale	*Orcinus orca*
Long-finned pilot whale	*Globicephala melaena*
Minke whale	*Balaenoptera acutorostrata*
Northern bottlenose whale	*Hyperoodon ampullatus*
Otter	*Lutra lutra*
Risso's dolphin	*Grampus griseus*
White-beaked dolphin	*Lagenorhynchus albirostris*

Appendix 2: Moray Firth Coastal Zone User and Conflicts Questionnaires.

Two main types of questionnaire were used to identify the users of the Moray Firth, and the conflicts of interest between them.

Where little was known about a particular user, for example, a sports club or a aquaculture development, the questionnaire sent out requested general information about the users activities, with a question concerning coastal conflicts built in.

Where general information was already available about a user, a questionnaire was sent out that was specifically concerned with coastal conflicts and interactions.

A letter of introduction and explanation from the researcher was attached to each questionnaire issued. Each was personalised by means of a word processor so that each was individually addressed, departmental headed paper was also used to give a more 'official' impression. Finally, in accordance with accepted practice, a stamped addressed envelope was also included so that the costs of completion were limited to individuals time.

The letter of introduction and explanation from the researcher and examples of the different questionnaires sent to recreational, mineral extraction, aquacultural and coastal industry, port and shipping users of the Moray Firth comprise the remainder of this appendix.

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Date .....

Dear .....

I am a researcher at the Institute of Offshore Engineering which is part of Heriot-Watt University. My thesis is concerned with the management of the coastal zone in Scotland (i.e. both the land and sea areas adjacent to the coastline, covering an area which extends 2km inland and out to the limits of the UK's territorial sea), with particular emphasis being placed on the north-east coast between Duncansby Head in Caithness and Rattray Head in Buchan (i.e. the Moray Firth).

Part of my research aims to catalogue the different users of the above coastal zone (for example; coastal industry, offshore industry, commercial shipping, waste disposal, nature conservation, military activities, commercial fishing, recreation, tourism, aquaculture and mineral extraction), as well as interactions / conflicts of interest between them. As part of this effort I am enclosing a short questionnaire which I hope you will be willing to complete regarding ..... within the Moray Firth coastal zone.

The final report incorporating the responses from the different users will have practical application. It will contribute to the debate on the management and planning of the coastal zone in Scotland. Your co-operation will therefore be greatly appreciated.

I am enclosing a stamp addressed envelope and look forward to hearing from you. If further information is required please contact me, the Institute telephone number is at the head of this paper.

Yours sincerely

Peter Boon BSc, MSc.

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Coastal User / Conflict Questionnaire.

(Wildfowling)

Question 1: What is the full name and foundation date of your club ?

.....

.....

Question 2: What is the present membership of your club (1994) ?

.....

.....

Question 3: Within the Moray Firth please specify traditional fowling areas used by the members of your club (this will be important for mapping purposes).

.....

.....

.....

Question 4: Are you aware of any other wildfowling clubs operating within the Moray Firth Coastal Zone ?

Yes ..... No .....

If your answer is Yes, please state how many, and where possible please supply appropriate contact names and addresses for these clubs:

N° .....

.....

.....

.....

Question 5: Which of the following categories affects the activities of your club members ?

The affecting categories are; Other Recreational Activities, Nature Conservation, Commercial Activities, Industrial Activities, Military Activities, and Others (please specify). For each of these six categories, would you firstly please tick either Yes, No, or Not Applicable.

Where you have answered Yes, could you then please elaborate by stating the possible nature of the affecting activities, for example; **(please answer after the lined off examples)**

.....

Other recreational activities: Yachting / sailing, water skiing, wind surfing, speed boating, hand-gliding, jet skiing, SCUBA, horse riding, trail biking etc.

Commercial activities: Fishing, shipping, coastal land developments, aquaculture etc.

Industrial activities: Oil and gas developments (on and offshore), pollution, aggregate mining, coastal industrial estates etc.

Military activities: Naval exercises, submarine operations, target areas, weapons testing sites, bombing ranges etc.

Nature conservation: Restricted access to areas (e.g. Private land, Sites of special scientific interest) etc.

Others (Please specify): Coastal erosion, lack of access to the shore, tourist activity etc.

.....

Recreational Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....

.....

Commercial Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....

.....

Industrial Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....

.....

Military Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....

.....

Nature Conservation Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....

.....

Others (Please specify) Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....

.....

Secondly, could you please discuss, in as much detail as possible, any specific conflicts or incidents your club or its members have actually experienced as a result of the above interactions

you have indicated. For example, congested land space leading to the loss of wetland habitat, impeded access to the shore, disturbance of birds by such things as noise pollution from other activities (e.g. speed boats, jet skis, RAF jets etc) or the loss of traditional fowling areas to other activities such as coastal industrial developments etc

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Please continue your discussion of interaction examples on the back of sheets if required.

Question 6: Has the club had any contact with the District Authority, Regional Authority, Harbour Authority or other Government / Statutory agencies (especially regarding management of wetlands and the birds that use them) ?

Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate: (i. e. what kind of contact and to what end ?)

.....
.....

Question 7: Does the club envisage any of the following in the future; further development to facilities, changes in the quantity or type of equipment held, or changes to club membership levels etc. ?

Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....
.....
.....

Club Name:

Completed by (Print Please): .....

Telephone No: ..... **Date:** .....

Coastal User / Conflicts Questionnaire

(Mineral / Aggregate Extraction)

Question 1: What is the full name of your company ?

.....
.....

Question 2: What was the foundation date of this company ?

.....

Question 3: How many people are employed by the company ?

.....
.....

Question 4: How many quarries does your company operate within the Moray Firth coastal zone, and what is their location ?

N° .....

.....
.....
.....

Question 5: What types of mineral materials are extracted from these quarries ?

.....
.....

Question 6: What is the average annual amount of material extracted by your company in the Moray Firth coastal zone ?

Amount = ...

Question 7: Are you aware of any other mineral extraction companies operating within the Moray Firth coastal zone ?

Yes ..... No .....

If the answer is Yes, please state how many of these are either on or offshore operations:

Onshore N° = ... Offshore N° = ...

Could you please supply appropriate contact names and addresses for the mineral extraction operations you have indicated above, stating whether they are onshore or offshore in nature:

.....
.....
.....
.....

Question 8: Which of the following categories could possibly affect your mineral extraction operation, generally speaking ?

The affecting categories are; Recreational activities, Commercial activities, Industrial activities, Military activities, Nature conservation and Others (please specify). For each of these six categories, would you please tick either Yes, No, or Not Applicable. Where you have answered Yes, could you then please elaborate by stating the possible nature of the affecting activities, for example; **(please answer after the lined off examples below)**

Recreational Activities:	Yachting / sailing, water skiing, wind surfing, speed boating, hand-gliding, jet skiing, horse riding, rambling, trail biking, hunting etc.
Commercial Activities:	Commercial fishing, commercial shipping, coastal land developments, aquaculture developments etc.
Industrial Activities:	Oil and gas developments (on and offshore), pollution, aggregate mining, coastal industrial estates etc.
Military Activities:	Naval exercises, submarine operations, target areas, weapons testing sites, bombing ranges etc.
Nature Conservation:	Inability to develop a site due to nature conservation designation e.g. SSSI (Site of Special Scientific Interest).
Others :	Coastal erosion, noise pollution, tourists etc.

Recreational Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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.....

Commercial Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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.....

Industrial Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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Military Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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Nature Conservation Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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Others (Please Specify) Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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Secondly, could you please discuss, in as much detail as possible, any 'specific' interactions / conflicts or incidents your company has actually experienced as a result of the above interactions you have indicated.
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Please continue your discussion of interaction examples on the back of sheets if required.

Company:
Completed by: (Print Please) .....
Telephone No: ..... **Date:** .....

Coastal User / Conflict Questionnaire.

(Aquaculture Developments)

Question 1: What is the full name and foundation date of your company ?

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Question 2: How many people does the company employ ?

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Question 3: What species of fin / shellfish do you cultivate ?

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Question 4: Where do you obtain your stocks, and what stage of development ?

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Question 5: What is the harvest figure per year for each species cultivated ?

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Question 6: What method is utilised to cultivate these species, e.g. cages, ropes, rafts, net bags, trestles, etc ? (Please give a brief outline of how your system works).

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Question 7: With as much detail as possible, please identify where within the Moray Firth you cultivate your fin / shellfish ?

.....

.....

Question 8: Please describe in as much detail as possible the distribution network operating after your fin / shellfish have been harvested ?

.....

.....

Question 9: Are you aware of any other aquaculture companies operating within the Moray Firth coastal zone ?

If your answer is Yes, please state how many, and where possible please supply appropriate contact names and addresses for these companies.

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Question 10: Which of the following categories could possibly affect your aquaculture activities ?

The affecting categories are; Recreational Activities, Nature Conservation, Commercial Activities, Industrial Activities, Military Activities and Others (please specify). For each of these six categories, would you please tick either Yes, No, or Not Applicable. Where you have answered Yes, could you then please elaborate by stating the possible nature of the affecting activities, e.g.; **(please answer below the lined off examples below)**

.....

Recreational activities:	Yachting / sailing, water skiing, wind surfing, speed boating, hand-gliding, jet skiing, SCUBA, horse riding, trail biking etc.
Commercial activities:	Fishing, shipping, coastal land developments, aquaculture etc.
Industrial activities:	Oil and gas developments (on and offshore), pollution, aggregate mining, coastal industrial estates etc.
Military activities:	Naval exercises, submarine operations, target areas, weapons testing sites etc.
Nature conservation:	Restricted access to areas (e.g. Private land, Sites of special *scientific interest*) etc.
Others (Please specify):	Coastal erosion, lack of access to the shore etc.

.....

Recreational Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

.....

.....

Commercial Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

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Industrial Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

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Military Activities Yes ..... No ..... Not Applicable .....

If your answer is Yes, please elaborate:

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.....

Nature Conservation Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:

.....

.....

Others (Please specify) Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:

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Secondly, could you please discuss, in as much detail as possible, any specific conflicts or incidents you have actually experienced as a result of the above interactions you have indicated. For example; congested water space leading to dangerous situations, restrictions on using certain areas of water, impeded access to the water, pollution affecting water quality, restrictions on developing the company or expanding its facilities, conflicts with conservation organisations, reduced production due to perdition by birds (e.g. Eider Ducks) and marine mammals etc. Please discuss any interactions 'you' have knowledge of (not just the above examples) below:

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Please continue your answers on the back of these sheets if required.

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Club Name: .....

Completed by (Print Please): .....

Telephone No: ..... **Date:** .....

Coastal Conflicts Questionnaire

(Coastal Industry, Ports & Shipping)

Question: Have any of the following activity categories ever affected the operations of your company (i.e. what conflicts / interactions have you had with other users of the Moray Firth) ?

The affecting categories are; Recreational Activities, Nature Conservation, Commercial Activities, Industrial Activities, Military Activities, and Others (please specify). For each of these six categories, would you please tick either Yes, No, or Not Applicable. Where you have answered Yes, could you then please elaborate by stating the possible nature of the affecting activities, for example; **(please answer after the lined off examples below)**

Recreational activities:	Yachting / sailing, water skiing, wind surfing, speed boating, jet skiing, sub-aqua diving, trail biking, rambling etc.
Commercial activities:	Fishing, shipping, coastal land developments, aquaculture activities (e.g. Salmon, Trout or Shellfish farm) etc.
Industrial activities:	Oil and gas developments (on and offshore), water pollution, aggregate mining etc.
Military activities:	Naval exercises, submarine operations, target areas, weapons testing sites, bombing ranges etc.
Nature conservation:	Restricted development in coastal areas (e.g. Sites of special scientific interest) etc.
Others (Please specify):	Coastal erosion, lack of harbour facilities / access to the shore, tourist activities etc.

Recreational Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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Commercial Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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Industrial Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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.....

Military Activities Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
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.....

Nature Conservation Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
.....
.....

Others (Please specify) Yes ..... No ..... Not Applicable .....
If your answer is Yes, please elaborate:
.....
.....

Secondly, could you please discuss, in as much detail as possible, any 'specific' conflicts or incidents your company has actually experienced as a result of the above interactions you have indicated. For example, congested water space and crowding on the coast; conflicts between commercial, military and leisure craft (including jet skies) for water space leading to dangerous incidents; restrictions on using certain areas of water; restrictions on developing the company or expanding its facilities; conflicts with conservationists or organisations; navigational problems caused by fishing gear or debris on the water from offshore operations etc. Please discuss any interactions 'you' have experienced (not just the above examples) below:

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.....Please continue your discussion of interaction examples on the back of sheets if required.

.....

Company name:
Completed by: (Print Please) .....
Telephone No: ..... **Date:** .....

Appendix 3: Questionnaire to Regional and District Council's.

The questionnaire divides into six sections, readily identifiable to the respondent by means of an index page. Together the sections examine the identification or otherwise of a coastal zone, arrangements for the administration of the coast, the nature of coastal ownership, existing policies and management, planning considerations and a summation of problems and conflicts.

Layout is determined by the nature of each question but basically depends on a simple Yes or No format supplemented by space for the amplification and illustration of answers as appropriate.

It was recognised from the outset that the information required to answer the questionnaire would probably not be found within one department. The questionnaire was therefore designed to fit between covers, secured by means of a removable plastic binder. Removal of the binder allowed pages to be separated and distributed to different departments, it also facilitated the typing of responses.

The questionnaire was directly initially at the Chief Executive of each Council, as listed in the Municipal Year Book. A letter of introduction and explanation from the researcher was personalised by means of a word processor so that each was individually addressed, departmental headed paper was also used to give a more 'official' impression. Finally, in accordance with accepted practice, a stamped addressed envelope was also included so that the costs of completion were limited to employees' time.

Follow up letters were sent to those Council's that failed to respond to the questionnaire.

For those Council's that still failed to reply, or replied that they did not have the time, due to work commitments, to fill out the questionnaire, shortened follow up questionnaires were sent out containing only four questions.

The letter of introduction and explanation from the researcher, a copy of the questionnaire, the follow up letter, and a copy of the shortened follow up questionnaire comprise the remainder of this appendix.

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Date .....

Dear .....

I am a researcher at the Institute of Offshore Engineering which is part of Heriot-Watt University. My thesis is concerned with the management of the coastal zone in Scotland (i.e. both the land and sea areas adjacent to the coastline), with particular emphasis being placed on the north-east coast between Duncansby Head in Caithness and Rattray Point in Buchan (i.e. the Moray Firth).

Part of my research aims to examine the role of local government within the above coastal area. To this end, I am contacting all authorities with an interest in the above coast and as part of this effort I am enclosing a questionnaire which I hope members of your authority will be willing to complete. The questionnaire aims to assess the 'official' viewpoint of your Council to management considerations in the coastal zone. It comprises six sections, which refer to Council functions in general.

The questionnaire has been designed to fit between covers, secured by means of a removable plastic binder. Removal of the binder allowing pages to be separated and distributed to different departments, it also facilitates the option of typing of responses. Space has been allowed for comments but please enclose additional material if available, particularly publications / maps which deal with issues covered in the questionnaire. Please invoice if appropriate.

The final report incorporating the responses from authorities will have practical application and will contribute to the debate on the management and planning of the coastal zone. Your co-operation will therefore be greatly appreciated.

I am enclosing a stamped addressed envelope and look forward to hearing from you. If further information is required please contact me, the Institute telephone number is at the head of this paper.

Yours sincerely

Peter Boon BSc, MSc.

ORKNEY OFFICE
Old Academy, Back Road, Stromness, Orkney KW16 3AW
Tel: 01856 850 605 Fax: 01856 851 135

Heriot-Watt University: Institute of Offshore Engineering

The Management of the Coastal Zone:

A Survey of Local Government Authorities along the Moray Firth Coastline

Completed by .....

Department .....

Telephone No .....

Date .....

Research Use Only

Authority Code:

Date despatched:

Date returned to IOE:

Date entered on disc:

Peter Boon BSc, MSc. **Institute of Offshore Engineering**

SECTION A: IDENTIFICATION OF A COASTAL ZONE

A1 Does your Council delimit (i.e. define an area with boundaries on a map) a coastal zone for any of its activities ?

Yes ..... No .....

If your answer is 'No', please go on to Question A2.
If your answer is 'Yes';

1.1 Is the area delimited identically for all Council activities ? Yes ..... No .....
or

1.2 Does it vary with different policy areas / departmental interests ? Yes ..... No .....

1.3 Can you list the parts of your Council which delimit a coastal zone and give the criteria by which it is defined, including whether it incorporates only land / only sea, or both ? (N.B. If you have several different zones please list the criteria by which each one is delimited).

Council Department recognising a coastal zone:	How delimited:
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A2 Does your Council produce any policies which are specifically directed at the coast (e.g. development of coastal settlements, conservation of the coastline etc) ?

Yes ..... No .....

If your answer is 'No', please go to Question A3.
If your answer is 'Yes';

2.1 Is the area considered coastal identical for all Council activities ? Yes ..... No .....
or
2.2 Does it vary with different policy initiatives / development interests ? Yes .... No ....

2.3 Can you list the activities (e.g. land use planning, transportation, tourism, recreation, nature protection, pollution control, coastal protection, industry etc) of your Council for which coastal policies are produced ?

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A3 Considering your previous answers, can you indicate what priority your Council gives to the coast ?

High ..... Medium ..... Low .....

A4 Would you include the coast as one of the five most important policy areas facing your Council ?

Yes ..... No .....

Regardless of the answer above, please list the five most important policy areas facing your Council (Nº 1 being the most important, and so on down to Nº 5).

Nº 1 .....
Nº 2 .....
Nº 3 .....
Nº 4 .....
Nº 5 .....

SECTION B: THE ADMINISTRATION OF THE COAST

B1 Are there any departments in your Authority whose interests do not extend to the coast?

Yes ..... No .....

If your answer is 'No', please go on to Question B2.
If your answer is 'Yes', can you specify these ?

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B2 How many departments have responsibilities for various aspects of the coast ?

Nº .....

B3 Are there any departments which have created a special division dealing specifically with the coast ?

Yes ..... No .....

If your answer is 'No', please go on to Question B4.
If your answer is 'Yes', can you specify these departments ?

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B4 How many committees have responsibilities which extend to various aspects of the coast ?

Nº .....

B5 Are there any committees which have a special division / sub-committee dealing specifically with the coast ?

Yes ..... No .....

If your answer is 'No', please go on to Question B6.
If your answer is 'Yes', can you list these ?

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B6 Are there any committees which are solely concerned with activities at the coast (e.g. Coast Protection Committees, Nature Conservation Committees, Recreational Committees etc) ?

Yes ..... No .....

If your answer is 'No', please go on to Question B7.
If your answer is 'Yes', can you please list these ?

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B7 Has your Council delegated any of its functions relating to the coast to any other body ?

Yes ..... No .....

If your answer is 'No', please go to Question B8.
If your answer is 'Yes', please specify.

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B8 Are any of your Council's activities in the coastal zone the subject of joint committees / study groups, with any other body (whether formal or informal) ?

Yes ..... No .....

If your answer is 'No', please go on to Question B9.
If your answer is 'Yes', please give details.

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B9 Can you give an indication of other linkages your Council has established with parties interested in the coast ?

Yes ..... No .....

If your answer is 'No', please go on to Question B10.
If your answer is 'Yes', please give details.

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B10 Do you believe your Authority should become more involved in management functions within the coastal zone ?

Yes ..... No .....

B11 Do you see the administration and management of the coast as inextricably linked with other Authority functions and other parts of your administrative area ?

Yes ..... No .....

Please expand if possible:

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SECTION C: OWNERSHIP OF THE COAST

(N.B. All these questions refer to areas of land - not individual buildings, depots etc).

C1 Are there any coastal areas (please consider not only land but near shore islands / causeways / piers / offshore waters etc) which are in central government ownership ?

Yes ..... No .....

If your answer is 'No', please go on to Question C2.
If your answer is 'Yes', can you please list these below and include if possible a plan / annotated tracing, showing the approximate extent and land use of any such areas ?

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C2 Are there any coastal areas (see C1) within your administrative area which are owned by your Council ?

Yes ..... No .....

If your answer is 'No', please go on to Question C3.
If your answer is 'Yes', can you list these below and include if possible a plan showing their approximate extent and land use (e.g. public open space, residential) ?

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C3 Can you list, and indicate if possible on a map, the other major ownership's and their usage in the coastal area ? (I would be particularly interested in National Trust holdings, major private land holdings, industrial estates and Port Authority holdings).

Yes ..... No .....

If your answer is 'No', please go on to Question C4.
If your answer is 'Yes', please list below.

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C4 Does your Authority see a need for increased public ownership at the coast ?

Yes ..... No .....

If your answer is 'No', please go on to Question C5.
If your answer is 'Yes', can you please expand ?

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C5 Are there any areas of coast your Council would like to acquire ?

Yes ..... No .....

If your answer is 'No', please go on to Question D1.
If your answer is 'Yes', can you list these areas and state why you would like to acquire them (e.g. for nature conservation).

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SECTION D: EXISTING POLICIES AND MANAGEMENT

D1 Are there any coastal areas within your administrative area which are the subject of protective designations ?

Yes ..... No .....

If your answer is 'No', please go on to Question D2.
If your answer is 'Yes', can you list these and indicate the designating authority ?

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D2 Are there any examples of conditions at the coast which are the subject of local bye-laws (e.g. parking on beaches, speed of vessels, public access, public behaviour) ?

Yes ..... No .....

If your answer is 'No', please go on to Question D3.
If your answer is 'Yes', please specify.

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D3 Does your Council provide any special coastal services (e.g. lifeguards etc) ?

Yes ..... No .....

If your answer is 'No', please go on to Question D4.
If your answer is 'Yes', please specify.

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D4 Does your Council provide any educational or information services based on the coastal zone (e.g. field centres, ranger / warden services, tourist information offices, classes in local schools etc) ?

Yes ..... No .....

If your answer is 'No', please go on to Question D5.
If your answer is 'Yes', please give details.

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D5 Does your Council actively market the coastal zone and any of its attractions / facilities ?

Yes ..... No .....

If your answer is 'No', please go on to Question D6.
If your answer is 'Yes', please specify and give the department concerned.

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D6 Is any of your coastal area covered by management agreements of any kind (e.g. traffic management, land use management, zoning policy (either by time or space)) ?

Yes ..... No .....

If your answer is 'No', please go on to Question D7.
If your answer is 'Yes', please give details.

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6.1 Do any of these management agreements extend over any part of the sea ?

Yes ..... No .....

If your answer is 'Yes', can you indicate this by adding the letter 'S' to the appropriate listings above (D6) ?

D7 Does your Council act as a Port or Harbour Authority ?

Yes ..... No .....

D8 Does your Council have any statutory involvement with Port or Harbour functions (e.g. Port Health) ?

Yes ..... No .....

If your answer is 'No', please go on to Question D9.
If your answer is 'Yes', please specify.

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D9 Are there any other authorities / agencies with powers within your administrative area who manage the sea ?

Yes ..... No .....

If your answer is 'No', please go on to Question E1.
If your answer is 'Yes', can you specify which authorities ?

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SECTION E: PLANNING OF THE COAST

E1 Do you have any Plans which relate to the coast ?

Yes ..... No .....

If your answer is 'No', please go on to Question E2.
If your answer is 'Yes', can you list these and indicate whether they are (a) statutory, (b) non-statutory ?

Name of Plan	Type
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E2 Does your Council have any specific development control guidelines covering the future use of the coast within your administrative area ?

Yes ..... No .....

If your answer is 'No', please go on to Question E3.
If your answer is 'Yes', can you specify these ?

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E3 Has your Council conducted any special studies / surveys into conditions at the coast (e.g. landscape quality, recreational possibilities) ?

Yes ..... No .....

If your answer is 'No', please go on to Question E4.
If your answer is 'Yes', can you list these below ?

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E4 Has your Council experienced any problems at the coast where existing planning powers were not sufficient to control proposed changes to the environment ?

Yes ..... No .....

If your answer is 'No', please go on to Question E5.
If your answer is 'Yes', can you give details ?

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E5 In planning the coast are there any areas where your Council feels joint administration with other bodies is necessary ?

Yes ..... No .....

If your answer is 'No', please go on to Question E6.
If your answer is 'Yes', can you give details ?

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E6 Does your Council think any reforms are necessary in local government relative to:

(a) the planning of the coast ? Yes ..... No .....
(b) the management of the coast ? Yes ..... No .....

If your answer is 'Yes' to either (a) or (b) can you give details ?

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E7 Does your Council think that existing powers are used to sufficient effect in managing the coastal zone ?

Yes ..... No .....

If your answer is 'Yes', please go on to Question F1.
If your answer is 'No', can you give examples of powers which could be used more widely (and any difficulties in using them) ?

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SECTION F: PROBLEMS CONFLICTS IN THE COASTAL ZONE

F1 Can you give the approximate % for the land at the coast in your region which would fall into the following categories ?

(a) Industrial / Commercial Districts : Areas with intensive uses of a heavy industry and commercial character.

.....%

(b) Urban Districts: Areas with intensive uses of an urban character.

.....%

(c) Residential Districts: Areas of medium intensity housing.

.....%

(d) Commercial / Recreational Districts: Medium and low intensity commercial and recreational areas and facilities.

.....%

(e) General Purpose Districts: Areas with medium intensity uses of generally rural character.

.....%

(f) Agricultural / Forestry Districts: Areas with low intensity uses that are resource oriented.

.....%

(g) Resource Protection Districts or Natural Areas: Consists of those areas that if developed are likely to be unsatisfactory in terms of adverse environmental effects (e.g. wetlands, estuaries, flood plains etc).

.....%

(h) Others (please specify)

.....%

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F2 Are there any particular problems your Council has had to contend with, or conflicts it has encountered in the coastal area ?

Yes ..... No .....

If your answer is 'No', please go on to Question F3.
If your answer is 'Yes', please can you list these and detail possible solutions ?

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F3 Are there any marine activities which have an impact at the coast within your administrative area ?

Yes ..... No .....

If your answer is 'No', please go on to Question F4.
If your answer is 'Yes', can you list these ?

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F4 Do you envisage marine developments in the future affecting your administrative area

Yes ..... No .....

If your answer is 'No', please go on to Question F5.
If your answer is 'Yes', please specify ?

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F5 Does your Council:

(a) have any contingency plans for coastal disasters such as oil pollution, sea level rise, storm damage, stranded vessels etc ?

Yes ..... No .....

If the answer is 'No', please go on to Question F5(b).
If your answer is 'Yes', please give details.

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(b) contribute to the contingency plans of other organisations ?

Yes ..... No .....

If your answer is 'No', please go on to Question F6.
If your answer is 'Yes', please give details (including the organisation with overall responsibility for the contingency plan).

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F6 Have your Council any other comments to make about coastal zone management within the Moray Firth, present or future ?

Yes ..... No .....

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Institute of Offshore Engineering

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Date .....

Dear .....

I am a researcher at the Institute of Offshore Engineering which is part of Heriot-Watt University. My thesis is concerned with the management of the coastal zone in Scotland (i.e. both the land and sea areas adjacent to the coastline), with particular emphasis being placed on the north-east coast between Duncansby Head in Caithness and Rattray Point in Buchan (i.e. the Moray Firth).

During the second week in May 1994 I sent a questionnaire entitled "The Management of the Coastal Zone: A Survey of Local Government Authorities along the Moray Firth Coastline" to the nine authorities, including your authority, with responsibility for the above coastal zone.

The response from authorities has been very good, with several replies from the nine contacts made. However, I have not received any information yet from your authority, although I do realise that your council staff probably have very many conflicting demands made on their time. However, I am very anxious to avoid any complete gaps in my coverage of the Moray Firth coast, and I am therefore taking the liberty of requesting your help again.

I would be very grateful if you could give me any indication of your authorities activities in the Moray Firth coastal zone; coastal protection, management schemes, land ownership, planning constraints for example. If you are unable to justify the time necessary to complete the questionnaire, perhaps you could consider just those sections for which data is readily available? Any information, however partial, would be most useful.

The final report incorporating the responses from authorities will have practical application and will contribute to the debate on the management and planning of the coastal zone. Your co-operation will therefore be greatly appreciated.

Yours sincerely

Peter Boon BSc, MSc.

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Date .....

Dear .....

Firstly, my I start by thanking you for completing the questionnaire I sent to you last year concerning ..... in the Moray Firth coastal zone. The answers and information provided have had a direct baring upon my research and the content of my PhD thesis. My I also take this opportunity to assure you that contributions you have made have been fully acknowledged within the text and referenced correctly within the bibliography.

One of the final sections of my research into the management of the coastal zone (i.e. both the land and sea areas adjacent to the coastline) of the north-east coast of Scotland between Duncansby Head in Caithness and Rattray Point in Buchan (i.e. the Moray Firth), is concerned with assessing the possibility of developing a theoretical zoning plan that would control coastal conflicts of use and at the same time result in maximum user satisfaction.

An explanation of work that I have done in order to try and achieve this, and the ways that your can become involved in the consultations can be found attached to this letter. The explanation should tell you everything you need to know in order to make your views known. However, if you have any questions or queries, do not hesitate to contact me or leave a message at the above telephone or fax number.

As stated previously, the final report incorporating all the responses from user groups and other organisations will have practical application and will contribute to the debate on the management and planning of the coastal zone. Your co-operation will therefore be greatly appreciated. If at all possible, I would like to have received all responses no later than the 1st June this year.

I am enclosing a stamped addressed envelope and look forward to hearing from you.

Yours sincerely

Peter Boon BSc, MSc.

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Appendix 4: Experimental Zoning Scheme for the Moray Firth.

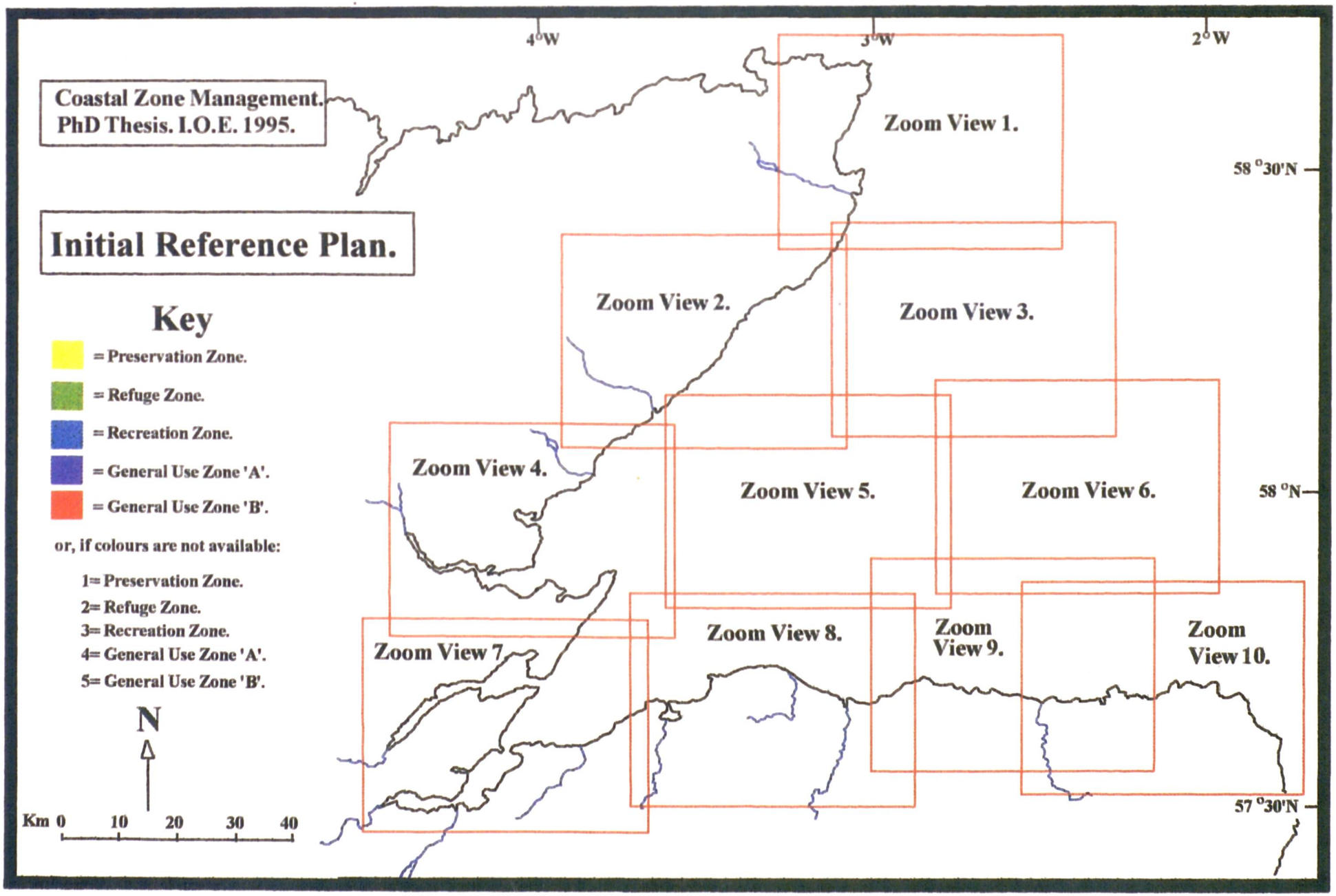
An attempt was made to develop an experimental zoning plan for the Moray Firth coastal zone that would both control conflicts of use and at the same time result in maximum user satisfaction. In order to achieve this it was decided to roughly follow the steps of the Australian SIRO-PLAN technique.

This technique involved the development of an Initial Reference Plan that consisted of an outline of the zone types and policy objectives and guidelines involved, a suggestions page, as well as the production of detailed maps of the Moray Firth, developed using the EASY-CAD 3 computer package.

Once complete the Initial Reference Plan was directly at interested parties identified previously by research work carried out as part of this thesis. These parties included; regional council's, district council's, river purification board's, recreation clubs and individuals, fishermen, fish farmers, aggregate extractors, coastal industrialist, conservation agencies and others.

Accompanying the Initial Reference Plan was a letter of introduction from the researcher which was personalised by means of a word processor so that each was individually addressed, departmental headed paper was also used to give a more 'official' impression. Along with this letter was an explanation of what was required form the recipient in order to become involved in the consultations to develop a zoning plan for the Moray Firth coastal zone. Finally, in accordance with accepted practice, a stamped addressed envelope was also included so that the costs of completion were limited to employees' time.

The letter of introduction from the researcher, the user explanation and a copy of the Initial Reference Plan comprise the remainder of this appendix.


Coastal Zone Management.
PhD Thesis. I.O.E. 1995.
Initial Reference Plan.
Key
= Preservation Zone.
= Refuge Zone.
= Recreation Zone.
= General Use Zone 'A'.
= General Use Zone 'B'.
or, if colours are not available:
1= Preservation Zone.
2= Refuge Zone.
3= Recreation Zone.
4= General Use Zone 'A'.
5= General Use Zone 'B'.
N
Km 0 10 20 30 40
4°W
3°W
2°W
58°30'N
58°N
57°30'N
Zoom View 1.
Zoom View 2.
Zoom View 3.
Zoom View 4.
Zoom View 5.
Zoom View 6.
Zoom View 7.
Zoom View 8.
Zoom View 9.
Zoom View 10.

User Explanation of the Development of a 'Theoretical' / Experimental Zoning Plan for the Moray Firth Coastal Zone.

Ideologically speaking, a good zoning plan is one which reflects the wishes of groups with a right to influence the form of the plan. Largely, this reduces to satisfying user groups demands, but the interests of future generations, vicarious users, third parties, and management personnel also need to be considered. In general terms preparation of a zoning plan involves:

- Identification of interest groups demands in relation to the zoning plan.
- Producing a plan which satisfies non-conflicting demands and develops a 'best compromise' plan in relation to conflicting demands.

A system of zoning has been developed by the Great Barrier Reef Marine Park Authority (GBRMPA) in Australia, which can be used to achieve the above requirements. This zoning system is known as SIRO-PLAN. As part of my research I am attempting to use this system to see if it is possible to achieve consensus on a theoretical zoning plan for the Moray Firth coastal zone.

The **first step** in the system is to develop a number of zone types. In principle, a zoning plan to control 'n' activities on a simple allowed / prohibited basis could utilise up to 2^n zone types, that is, all possible combinations of allowance and prohibition. The zone types developed for the theoretical Moray Firth zoning plan are shown in Table 1, which accompanies the Initial Reference Plan. Extra limitations and exemptions present within these zones are printed on the reverse side of Table 1.

The **second step** in the system is to develop policy objectives and guidelines upon which the selection of a zone type for each 'mapping unit' of the Moray Firth coastal zone is based. The policy objectives and guidelines developed for the theoretical Moray Firth zoning plan are as follows and are also repeated on the reverse of Table 1:

- Areas designated as National Nature Reserves will be zoned as Preservation Zones.
- Areas designated as Sites of Special Scientific Interest or Local Nature Reserves as far as possible should not be zoned as General Use A or B.
- All areas designated as Preservation Zones will be separated from General Use A and B Zones by a buffer Refuge Zone.
- As far as possible, avoid zoning areas where recreational activities predominate as General Use B.
- As far as possible, ensure that attractive areas for industrial development on land, and trawling offshore, are zoned General Use B, as General Use B is the only zone type in which industrial development and trawling are permitted. This policy seeks to maximise the areas available for these activities, but not to the detriment of other policies and guidelines.

The **third step** is to subdivide the area in question into individual mapping units. This is simply done by using a fine mesh grid (see Initial Reference Plan). Each mapping unit is roughly $500m^2$ in area.

The **fourth step** is to draw up an Initial Reference Plan which is then sent to interested parties within the Moray Firth for consultation (there are ten parts to the Initial Reference Plan, only those parts that are relevant to each interested party are sent out). The Initial Reference Plan itself is constructed by following the aforementioned policy objectives and guidelines, on which the selection of a zone type for each mapping unit is based.

At this point the demands, opinions, and concerns of interested parties can now be expressed in a number of ways:

- By disagreeing with the zone types proposed and the activities allowed or prohibited. For example, jet skiers may think that they should be allowed to ski in areas designated as Refuge Zones. Therefore, they should express this demand, which can then be taken onboard and may lead to a modification of the zone types and the activities allowed or prohibited within them.
- By disagreeing with, or adding to the policy objectives and guidelines. Any opinions here would be most useful.
- By altering the zone type of any of the mapping units, by changing the colour (or adding the appropriate number if colours are not available) of a square on the blank copy of the Initial Reference Plan (this is the main way the system allows for user group modifications). For example, it may be considered by a particular user that a certain mapping unit which is zoned General Use A in the Initial Reference Plan, should in fact be zoned General Use B. Therefore, on the blank copy the user changes the colour of that mapping unit from purple to red, or, if colours are not available writes the number 5 inside the mapping unit cell.

From all the data returned by the interested parties, that is, any alterations suggested to the zone types, policy objectives and guidelines, or the Initial Reference Plan, a new zoning plan can be developed, which will then hopefully be a 'Consensus Plan' which should represent maximum user satisfaction.

Note: When returning data please return the entire Initial Reference Plan. That is, cover page, table 1, suggestion pages, colour photocopies and altered blank copies. This ensures that suggestions and alterations are attributed to the correct individual, club or organisation, and also enables the colour photocopies to be used again. Thank you.

Table 1: Experimental Zoning Scheme for the Moray Firth Coastal Zone.

	Coastal Protection Zones				
Activity	**Preservation Zone**	**Refuge Zone**	**Recreation Zone**	**General Use Zone A**	**General Use Zone B**
Recreational:					
Camping / Caravaning	No	No	Yes	Yes	Yes
Canoeing / Wind Surfing	No	Yes	Yes	Yes	Yes
Golf	No	No	Yes	Yes	Yes
Jet Skiing	No	No	Yes	Yes	Yes
Rambling	No	Yes	Yes	Yes	Yes
Sailing / Yachting	No	Yes (i)	Yes	Yes	Yes
Sea Angling	No	No	Yes	Yes	Yes
Speed Boating / Water Ski.	No	No	Yes	Yes	Yes
Sub-Aqua	No	Yes (i)	Yes	Yes	Yes
Swimming	No	Yes	Yes	Yes	Yes
Wildfowling	No	Yes (ii)	Yes (ii)	Yes (ii)	Yes (ii)
Trial Biking	No	No	No	No	Yes
Commercial:					
Agriculture	No	No	Yes	Yes	Yes
Fish Farming	No	No	No	Yes	Yes
Trawling	No	No	No	No	Yes
Creels / Pots	No	No	Yes (iii)	Yes	Yes
Dredging	No	Yes (iv)	No	Yes	Yes
Industrial Development	No	No	No	No	Yes
Hydrocarbon Development	No	No	No	No	Yes
Aggregate Extraction	No	No	No	No	Yes
Residential Development	No	No	No	Yes	Yes
Port Development	No	No	No	No	Yes
Infrastructure:					
Engineering Works	No	No	Yes	Yes	Yes
Communications	No	Yes	Yes	Yes	Yes
Shipping & Navigation	No	No	No	Yes	Yes
Military:					
Bombing Ranges	No	No	No	No	Yes
Bases	No	No	No	Yes	Yes
Exercise Areas	No	No	No	No	Yes
Waste Disposal:					
Dumping	No	No	No	No	Yes
Effluent Discharge	No	No	No	Yes (v)	Yes
Collecting:					
Scientific Research	Yes (vi)	Yes	Yes	Yes	Yes

Limitations & Exemptions present within Table 1:

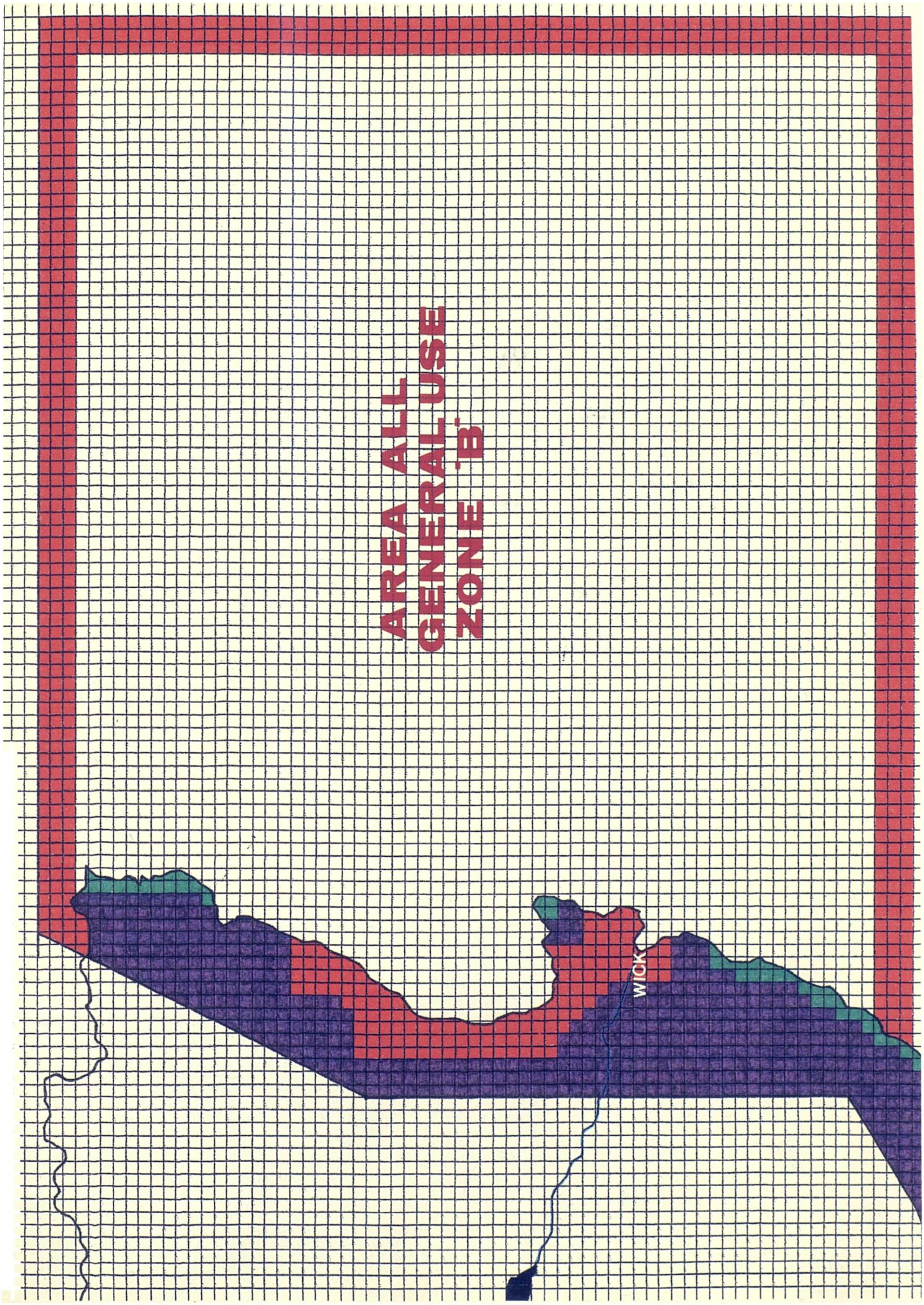
In the table above; (i) means that all vessels are asked to avoid anchoring in Refuge Zones whenever possible, (ii) relates to the fact that the majority of wildfowling takes place within the foreshore, and the Crown therefore retains rights by which members of the public may engage in wildfowling between September 1st and February 20th, (iii) means that creel pot buoys must be brightly coloured and clearly visible at night as well as during the day, (iv) relates to mussel dredging in the Dornoch Firth, which is the only area of Refuge Zone where dredge fishing is permitted, (v) means only effluent that has been processed beyond primary treatments can be released into areas categorised General Use Zone A, and finally, (vi) means that only essential non-manipulative research can occur in a Preservation Zone.

Policy Objectives & Guidelines:

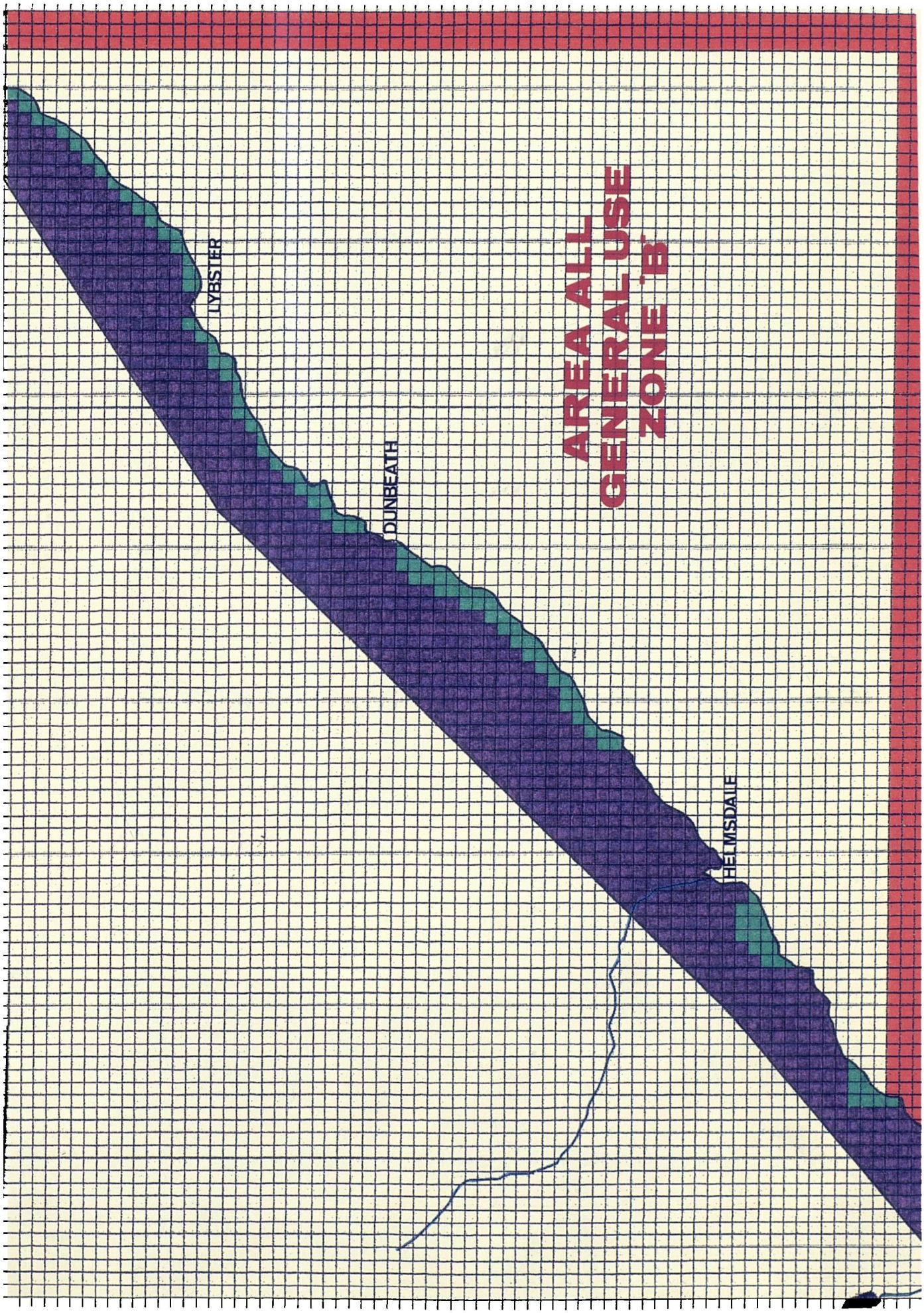
- Areas designated as National Nature Reserves will be zoned as Preservation Zones.
- Areas designated as Sites of Special Scientific Interest or Local Nature Reserves as far as possible should not be zoned as General Use A or B.
- All areas designated as Preservation Zones will be separated from General Use A and B Zones by a buffer Refuge Zone.
- As far as possible, avoid zoning areas where recreational activities predominate as General Use B.
- As far as possible, ensure that attractive areas for industrial development on land, and trawling offshore, are zoned General Use B, as General Use B is the only zone type in which industrial development and trawling are permitted. This policy seeks to maximise the areas available for these activities, but not to the detriment of other policies and guidelines.

Note: **"The essence of the exercise is that everything, and every opinion is up for discussion. If you don't like the way things look in the Initial Reference Plan, your views can change it. It must be remembered however, that this is a theoretical exercise of purely academic importance, and that there are no plans to implement a real zoning plan within the Moray Firth. Having said this, if a zoning plan were ever to be implemented in the future, it would be important to demonstrate now that a theoretical plan could be developed that involved full consultation with individuals, clubs, businessmen and other agencies / organisations, so that they would be involved, and their views taken into account in the development of any real zoning plan."**

Zoom View 1: Duncansby Head & Wick. **Sent to:** .....

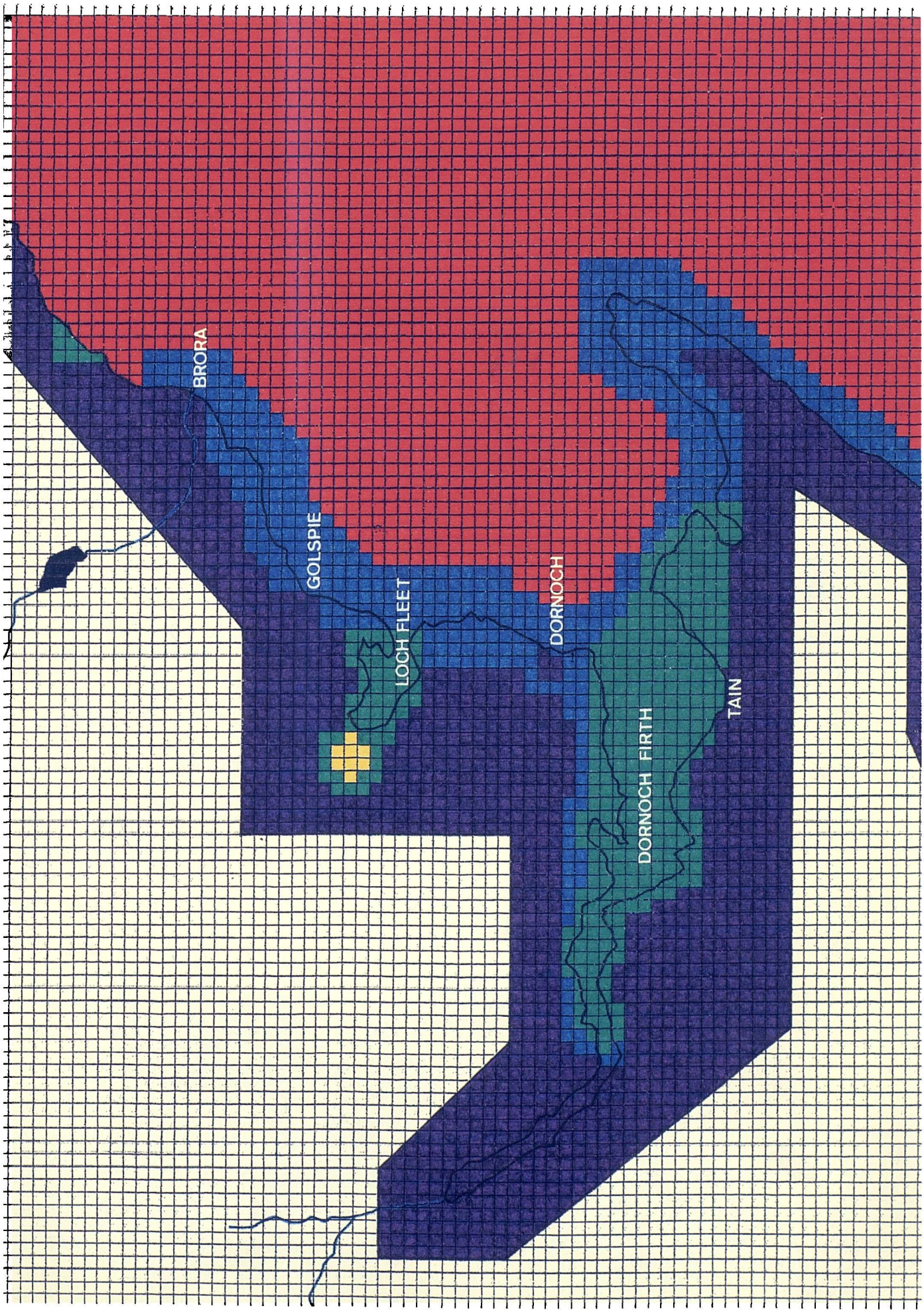


Zoom View 2: Lybster & Helmsdale. **Sent to: .....**



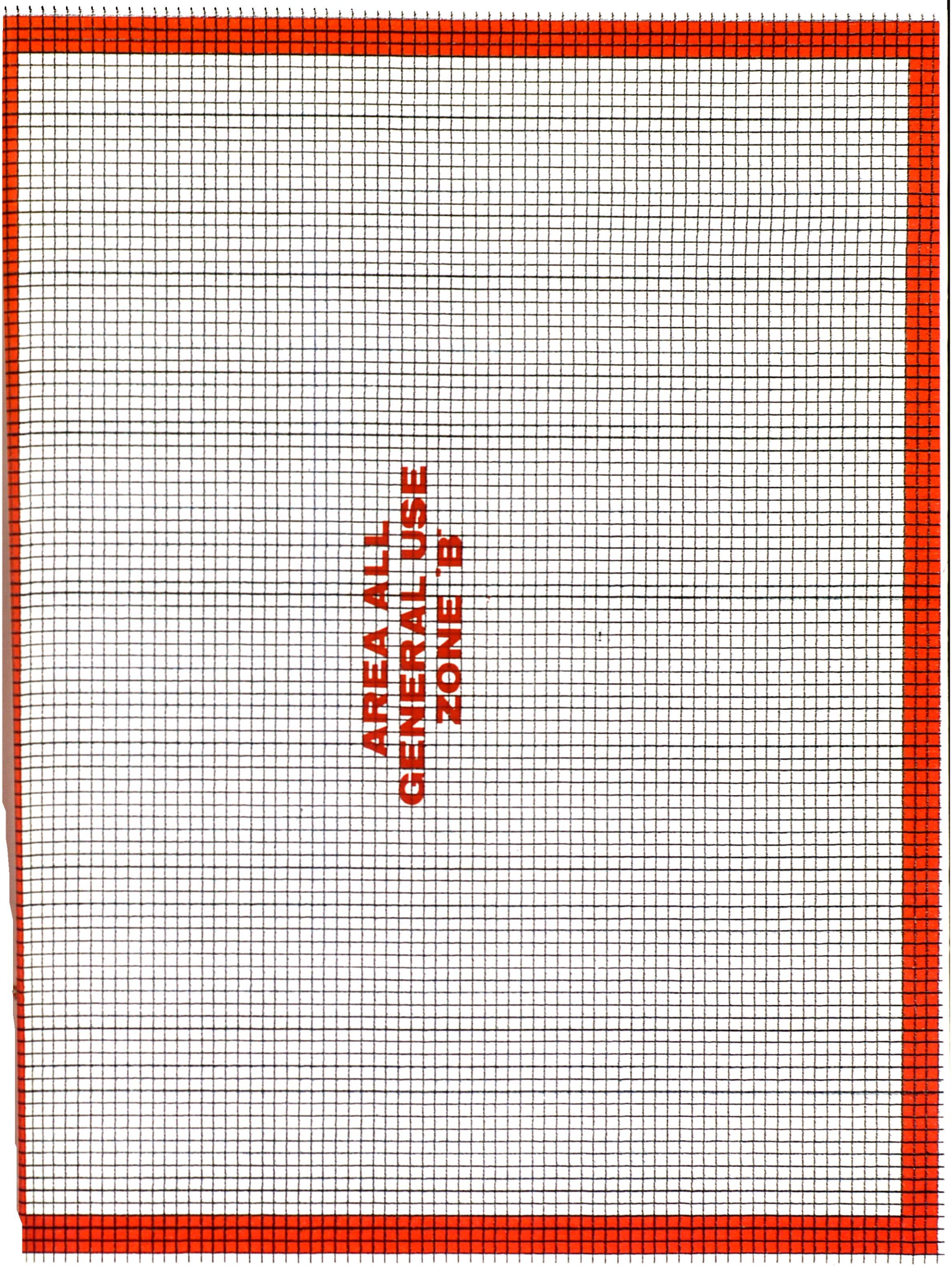
Zoom View 3 **Sent to:** .....

Zoom View 4: Brora, Golspie & the Dornoch Firth. **Sent to:** .....

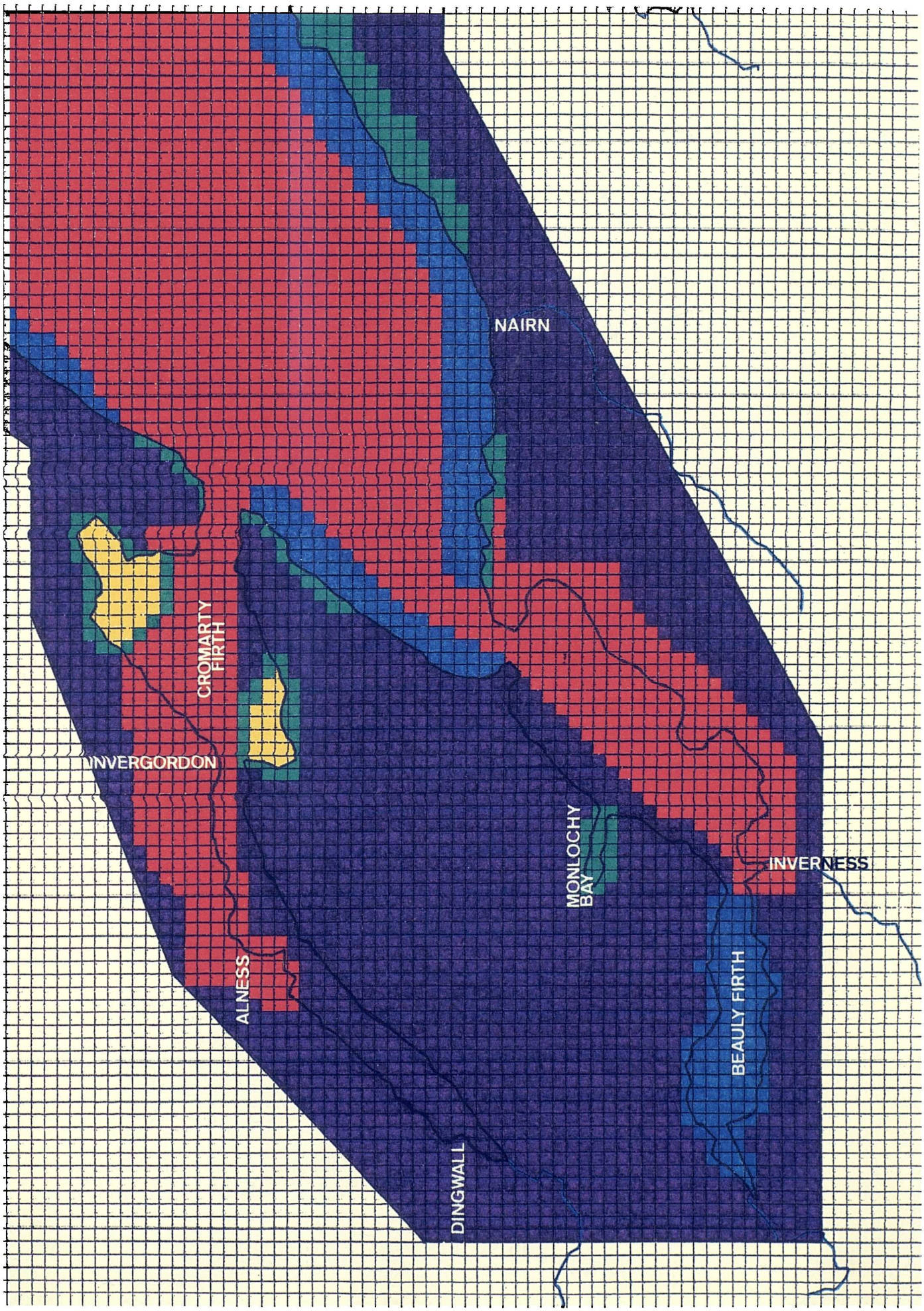


Zoom View 5: Central Moray Firth. **Sent to:** .....

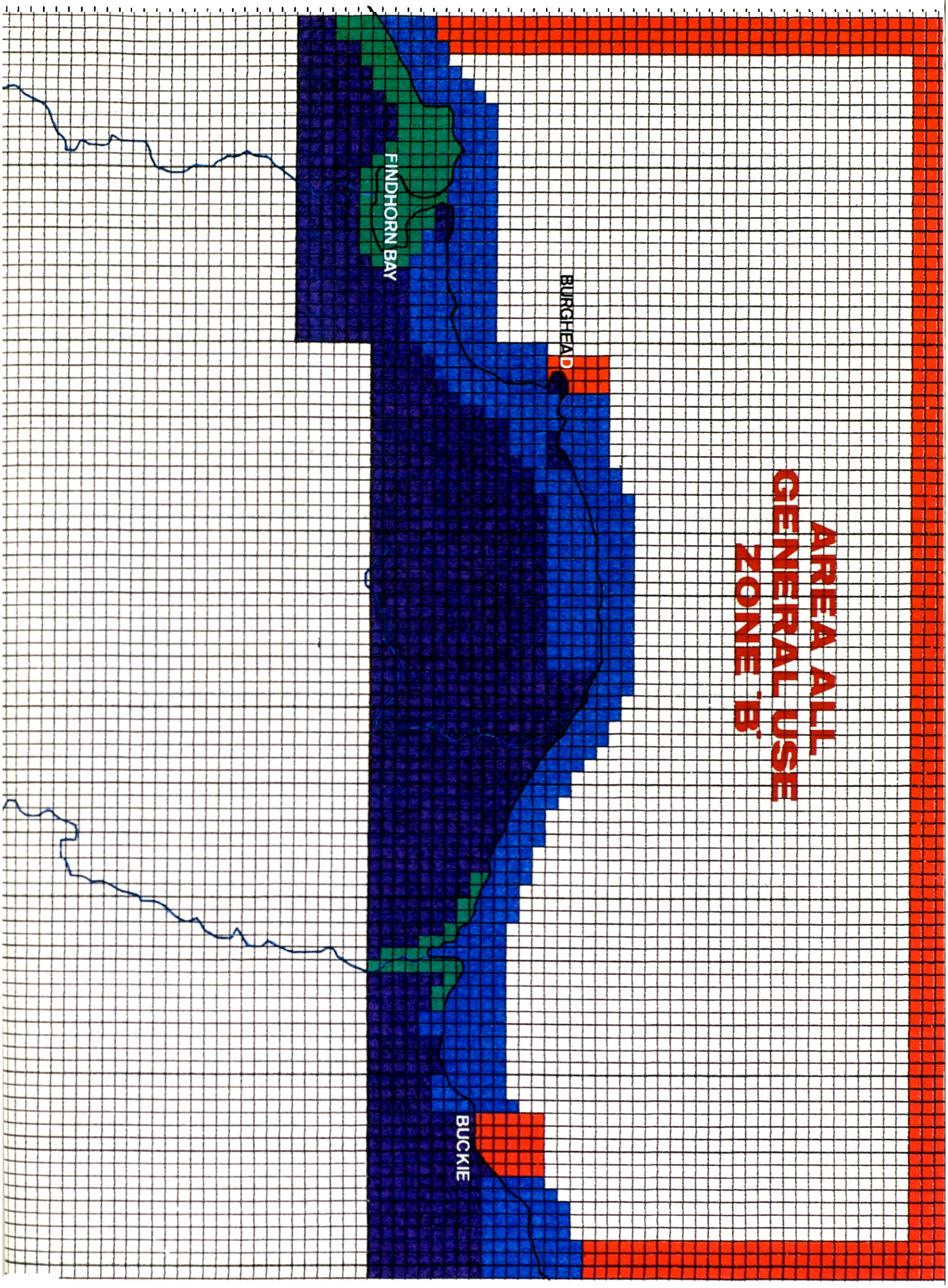
Zoom View 6: **Sent to:** .....



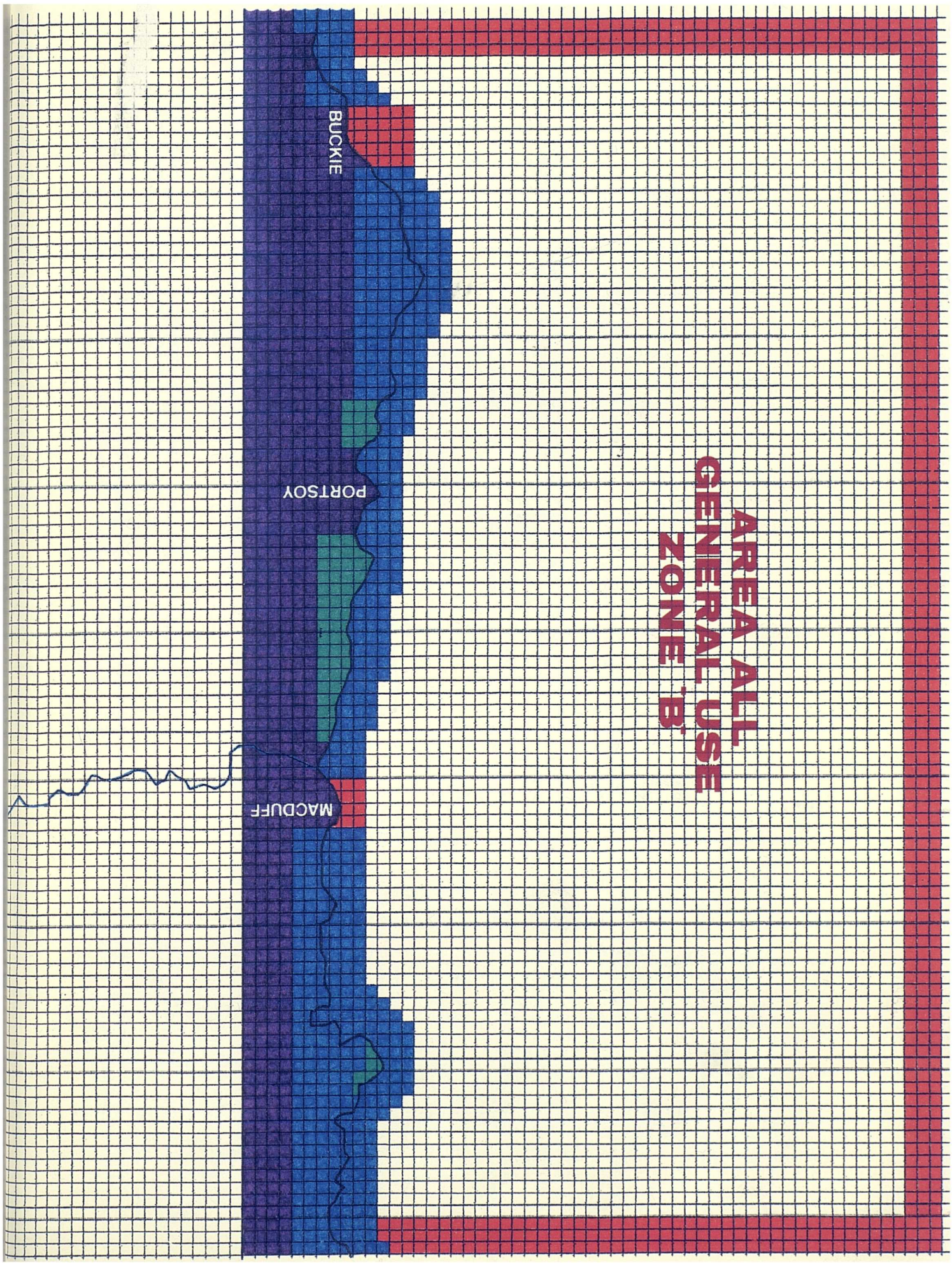
Zoom View 7: Cromarty, Inverness &Beauly Firths. **Sent to:** .....



Zoom View 8: Moray District **Sent to: .....**



Zoom View 9: Western Banff & Buchan Sent to: .....



Zoom View 10: Eastern Banff & Buchan Sent to: .....